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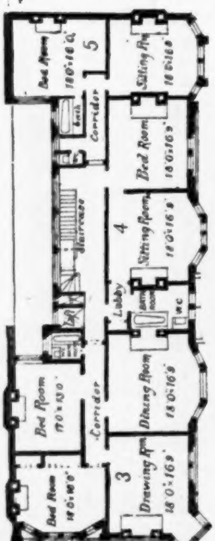

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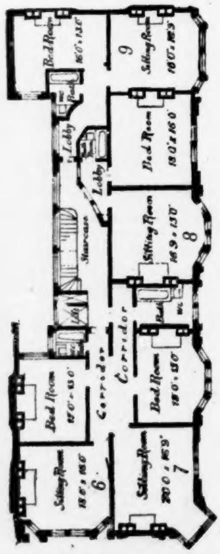

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Rank, Ship, or Regiment.

Address to which Journals and other communications should be sent.

The name of any member who fails to pay his annual subscription for two years is removed from the List of Members, but the member may be re-admitted as a new member on the usual terms.

Members of the United Service Institution of India on leave to the United Kingdom, and officers of the Colonial Naval and Military Forces who are temporarily in this country on duty, can become temporary members, and make use of the Institution on payment of Five Shillings per six months.

The Institution contains the best professional Library in the United Kingdom; an excellent collection of Maps and Charts; Reading and Smoking Rooms provided with the leading papers, periodicals, and writing materials; an interesting Museum; and a Theatre in which lectures upon professional subjects, followed by discussion, are frequently given.

The Journal, published monthly, is sent post free to all members. It contains the lectures given in the Theatre, articles on professional subjects, naval and military otes, book notices, &c.

H.M. Ship Britannia off Cadiz
October 30th 1805 ~

Dear Parents

Before you receive this I am afraid you will be
uneasy at not hearing of my safety during our late glorious contest
with the Combined Fleets of France & Spain which took place on
Monday the 21st of October as follows At Day-light we had the
Satisfaction of seeing our Enemy about 8 or 10 miles to leeward of us
Lord Nelson immediatly made the Signal to close the Enemy and
Prepare for Battle and about 12 o'Clock we were close up with
them ~~37~~ 43 Sail in number 33 of which were of the line and we
27 = The Royal Sovereign Vice Admiral Collingwood first opened
the fire on the Enemy which was most gallantly maintained
by the whole Fleet for upwards of 6 hours successively when
we found our selves in possession of upwards of 20 Sail of the
Line of their Ships, one of which was then on fire and shortly

after blew up with a most terrible explosion yet a grand
but awful sight as some hundreds of souls must have
perished with her Night coming on we found a difficulty
in securing our Prizes but which we did as well as possible
not knowing in what state our own Ships where in or whether
our Noble Commander had outlived the glorious Action when
it was with heart felt sorrow we shortly after heard he had
expired of his Wounds got in the contest. I am very happy to say
that the Britannia was certainly a very fortunate Ship
during the whole time as we had not above 10 Killed & 41 Wounded
although we where the 4th Ship in Action and the last out of
it and I doubt not but it will be found that She does honour
to all who belongs her, as our fire was not directed to ~~other~~ One particular
Ship but as soon as one had struck to us we immediatly made
to others and at one time had 5 Ships blazing away upon us
but we soon tired them out.

to others and at one ...
but we soon tired them out.

As I told you before I was stationed; at the Signals & Colours in the time of Action and being on the Quarter Deck I had an opportunity of seeing the whole of the Sport which I must own rather daunted me before the first or second broadside but after them I think I never should have been tired of drubing the Jokers particulary when my Ship mates began to fall arround me which in the room of disheartening an Englishman only encourages him, as the sight of his Country Man's blood makes his heart burn for revenge

I am very sorry to inform you that my worthy friend our Signal Lieutenant was knocked down by a double headed shot close by my side & immediatly expired much lamented by his brother Officers & every one in the Ship, I had several very narrow escapes from the Enemy's Shot but thanks be to the Lord he has still spared me thro his great goodness.

Too much credit cannot be given to Lord Northesk & Capt Bullen for their gallant Conduct during the Engagement indeed it was the case with every Officer & Man in the Ship. immediatly the Enemy had struck I went on board one of the French prizes to take possesion of her and when I got there I may well say I was shocked to see the sight as I believe there was not less then 3 or 400 Bodies lying about the Decks cut & mangled all to pieces some dying and others Dead we took the remainder of the men that were alive on board of our own Ships at which they seem'd very glad And from the Information we can get from them they really came out of Cadiz with an intention of fighting not thinking us to be above 17 sail of the line and them under the Command of Sir Robt Calder (but he was not with us at all) and that Lord Nelson was in England sick. so they thought they were an equal match for our 17. with there 37 and in fact made themselves so sure of taking us into Cadiz. that several

were an equal match for ... themselves so sure of taking us into Cadiz that several

Private Gentlemen came out of Cadez as passengers on purpose to see the Action and have the pleasure of towing us in but they were once more deceived in our Wooden Walls amongst the Prisoners in our Ship there are 5 or 6 of these Gentlemen of pleasure and I think they are in a fair way for seeing an English Prison before they return to Cadez again –

I am very sorry to inform you that before we could get our prizes off the Enemy's coast it came on so heavy a Gale of wind that it was with difficulty we could keep our own desabled Ships off the Lee Shore and I am greatly afraid that has been the cause of us loosing several of our prizes but as yet can say nothing respecting the – consequence of the Gale tho it is now coming on fine – Weather again and I hope shall be able to give a better account of the prizes then we had reason to expect during the Gale

We do not yet know what has become of the remainder of the Enemy's Fleet who took to there Heels as soon as they saw we had got so many of their ships in our possession and I am sorry to say we could not follow them our own fleet being so much disabled—

I hope it will not be long before our Ship returns to England that I may have the Pleasure of hearing from you which I have never done since we left the Channel & In hopes that this gallant Action will be the means of restoring Peace to England and that we shall soon meet together again I remain in good health hoping this will find you all in ~~good health~~ the same state and relations and friends to whom give my kind Love & accept the same yourselves from your truly affectionate & Loving Son

John Wells

You must excuse this scribble as really I was so anxious to let you hear from me that I had not time to take much pains in fact we are yet in a very confused & fatigued state.

His Majesty's Ship Britannia off Cadiz

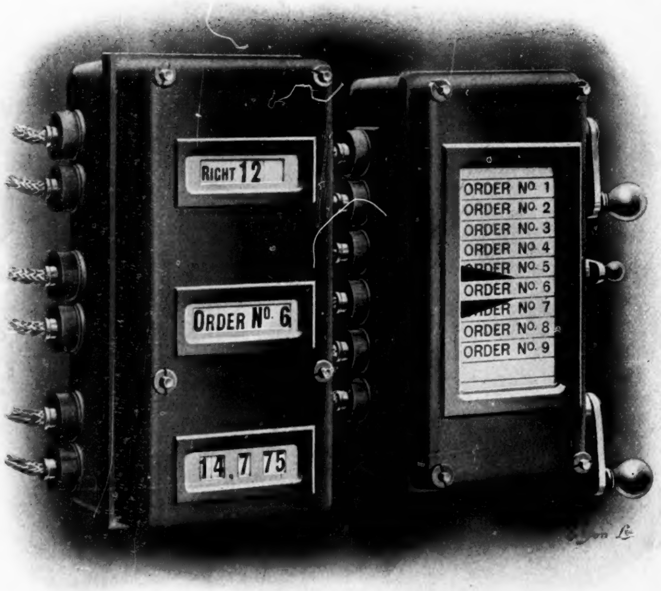
October 30th, 1805

Mr Tho Wells

Mason Street

Hull, Yorkshire.

P.S. Since writing the above Lieut Milnier who left our Ship a short time ago has come from Carthegena and been on board us with the pleasing intelligence of the totall defeat ~~Fleet~~ of the Enemy's Fleet out of that Port.



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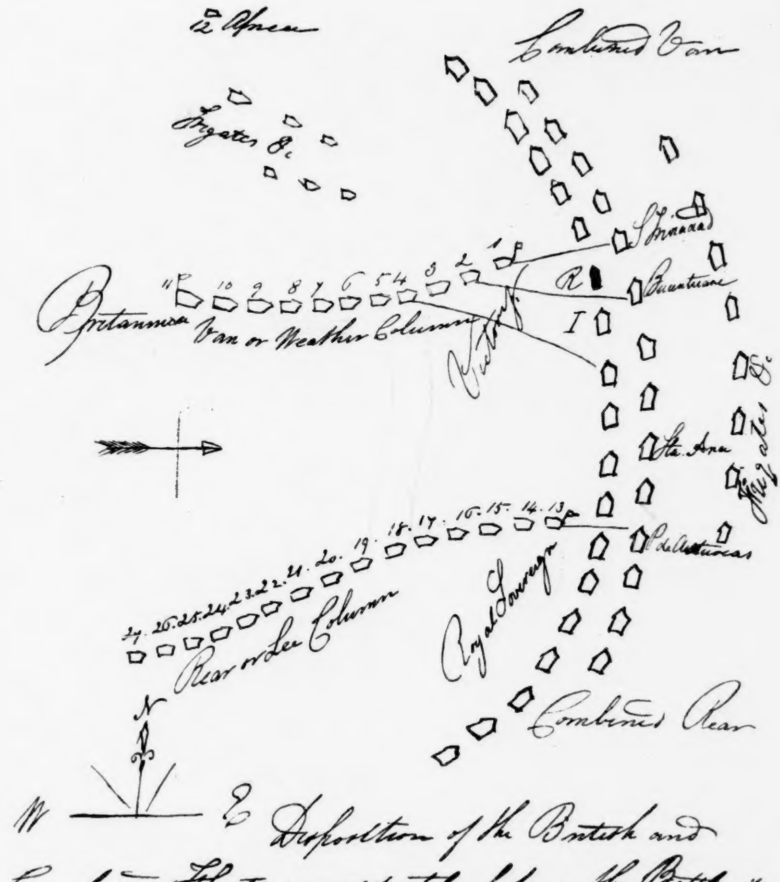

PLAN OF THE BATTLE OF TRAFALGAR.

DRAWN BY MR. JOHN WELLS, SIGNAL-MIDSHIPMAN OF H.M.S. "BRITANNIA," ACCOMPANYING LETTER WRITTEN BY HIM TO HIS PARENTS AFTER THE BATTLE, DATED OCTOBER 30th, 1805.

J. J. K. & Co., Limited, London.

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OF THE

ROYAL UNITED SERVICE INSTITUTION.

VOL. LI. JANUARY, 1907. No. 347.

[*Authors alone are responsible for the contents of their respective Papers.*]

SECRETARY'S NOTES.

1. The following officers joined the Institution during the month of December:—

Lieutenant C. E. Turle, R.N.
Captain H. F. E. Lewin, R.A.
Captain P. H. Dundas, Indian Army.
Captain J. Jardine, 1st Nottinghamshire V.R.C.
W. M. Cairncross, Esq., late Lieutenant Victoria Field Artillery (Militia).
Captain G. F. F. Foulkes, East Coast V.R.C. (I.A.)
Lieutenant H. St. J. L. Winterbotham, R.E.
Captain A. D. Hunter, 2nd V.B. Manchester Regiment.
Lieutenant C. M. Davies, Rifle Brigade.
Commander C. B. Miller, R.N.
Captain E. H. B. Norrish, 1st V.B. Devonshire Regiment.
Captain H. Crawshay, Worcestershire Regiment.
Lieutenant H. F. E. MacMahon, Indian Army.
Lieutenant J. S. M. Ritchie, R.N.
Captain the Earl of Devon, 3rd Bn. Somersetshire Light Infantry.
Second Lieutenant V. Dupree, 3rd Dragoon Guards.
Lieutenant C. Lamb, Border Regiment.
Second Lieutenant J. F. Chenevix-Trench, Northumberland Fusiliers.
Lieutenant E. D. Roberts, Indian Army.
Captain T. C. Mudie, Royal Scots.
Captain F. D. Logan, R.F.A.
Captain S. H. Hooper, late R.H.A.

(No officer of the Royal Naval Reserve or the Imperial Yeomanry joined the Institution during the month.)

2. The Council have pleasure in reporting that up to the end of the year 1906 the list of members shows an increase of 35. They, however, hope that members of the Institution will not relax their energy in the direction of introducing new members. During the past year 250 officers joined the Institution, the various branches of the Services being represented as follows:—

Royal Navy	26
Royal Naval Reserve and R.N. Volunteer Reserve	6
Regular Army	183
Militia	14
Imperial Yeomanry	9
Volunteers	12
Total	250

3. *Additional Lectures*: Wednesday, 13th February, 1907, "The Strategical Conditions of the North Sea as Improved by the Edinburgh and Glasgow Canal and the Dover and Calais Tube Railway," by Vice-Admiral Sir Charles Campbell, K.C.M.G., C.B., D.S.O.; Wednesday, 27th

February, 1907, "National and Non-National Armies—a Study in Military Policy," by Mr. F. Ellis-Barker (O. Eltzbacher); Wednesday, 20th March, 1907, "The Factor of Mobility in Strategy," by Colonel F. N. Maude, C.B., Hampshire R.E. (Vols.), late R.E.

4. With reference to the Secretary's Notes in the December JOURNAL, the Council desire to intimate that the entire cataloguing and rearranging of the Admiralty Charts were kindly executed by Commander W. F. Caborne, C.B., R.N.R.

5. The Council have decided that in future all Essays submitted for the Gold Medal must be sent in triplicate, typewritten, and not in single copies as at present.

6. The following additions have been made to the Museum:—

(i.) A Model of Long Cecil, a gun made at Kimberley during the siege in 1900, by Mr. Labran, an American engineer, who was killed shortly after his work was completed. The Model is made out of Boer ammunition fired into Kimberley or taken from Boer prisoners captured by the Kimberley garrison.
Deposited by H.M. King Edward VII.

(ii.) A Life-sized Figure in Wax of a Matabele Warrior.
Deposited by H.R.H. The President.

(iii.) Naval Sword of early XIX. Century, which belonged to Midshipman John Wells, R.N., who served on board H.M.S. "Britannia" from 1803-5, and was present at the battle of Trafalgar and stationed at the signals. He entered the Navy 9th August, 1803, at the age of 19, and served until 28th September, 1816. Amongst other ships on which he served were the "Sampson," the "Excellent," the "Royal William," and the "Julia," in the last of which ships for eleven months he was guarding Napoleon I. at St. Helena.
Bequeathed by his daughter, Mrs. W. A. Older.

(iv.) Mahogany Brass-bound Writing Desk which belonged to Lieutenant John Wells, R.N. *Bequeathed by Mrs. W. A. Older.*

(v.) The Boulton Medal for Trafalgar, given to Midshipman John Wells, R.N. *Bequeathed by Mrs. W. A. Older.*

(vi.) Letter written to his parents by Midshipman John Wells, R.N., describing the Battle of Trafalgar; dated 30th October, 1805. *Bequeathed by Mrs. W. A. Older.*

(vii.) Sketch by Midshipman John Wells, R.N., of the disposition of the British and combined fleets just before the Battle of Trafalgar. *Bequeathed by Mrs. W. A. Older.*

(viii.) A Maple Wood Snuff Box which belonged to Lieutenant John Wells, R.N. *Bequeathed by Mrs. W. A. Older.*

(ix.) Two Signal Books (1808) used by Lieutenant John Wells on H.M.S. "Excellent." *Bequeathed by Mrs. W. A. Older.*

(x.) Cockade cut from the hat of a dead French seaman by Midshipman John Wells, R.N., when boarding a prize after the Battle of Trafalgar. *Bequeathed by Mrs. W. A. Older.*

(xi.) Various personal documents relating to Lieutenant John Wells, R.N. *Bequeathed by Mrs. W. A. Older.*

(xii.) A Print in Colours of the Death of Nelson, from the original painting by S. Drummond.
Bequeathed by Mrs. W. A. Older.

7. The Council have arranged for a course of Military History Lectures to be delivered of an afternoon during the months of April and May on the subjects set for the May Promotion Examinations. The dates of the Lectures will be announced in due course. The Lecturer will be Mr. J. H. Anderson, Barrister-at-Law.

RECENT PROGRESS IN AËRIAL NAVIGATION,

By Colonel J. D. FULLERTON, R.E. (Retired), F.R.G.S.
Member of Council, Aeronautical Society of Great Britain.

Thursday, 15th November, 1906, at 3 p.m.
Major B. F. S. Baden-Powell, in the Chair.

SYLLABUS.

Introductory remarks.

Section I.—Dirigible Balloons.
General Characteristics. Size, weight, etc. Constituent Parts. Forces acting on a Dirigible in Flight. Power required for Flight. Stability. Constructional details. Some typical Dirigibles. General Remarks.

Section II.—Flying Machines.
General Characteristics. Size, Weight, etc. Constituent Parts. Forces acting on a Flying Machine. Power required for Flight. Stability, Constructional details. Some typical Flying Machines. General Remarks.

Section III.—The present position of the Aerial Navigation question.

Concluding remarks.

Appendix I.—List of journals, etc., giving useful information regarding Aerial Navigation.

Appendix II.—Further trials of Zeppelin II.

Appendix III.—The Santos Dumont Flying Machine.

INTRODUCTORY REMARKS.

IN 1892 I gave a lecture on Aerial Navigation before the members of this Institution, and explained generally the principles which guide the construction of machines for navigating the air. Since that date great progress has been made with both dirigible balloons and flying machines, and I think that an account of some of the more successful airships and the details connected with them may be found useful to those who desire to study the subject, or construct machines for their own use.

As before, I propose to divide the lecture into two parts, viz.:—

a. Dirigible Ballooning, or navigation by machines lighter than the air.

b. Aviation, or navigation by machines heavier than the air.

SECTION I.

Dirigible Balloons.

1.—*General Characteristics.*

In this system the chief characteristics are:—

1st. The weight of the whole machine is supported by a balloon or bag filled with some gas lighter than air, such as hydrogen, coal gas, etc., so that no power has to be provided for the *support* of the apparatus.

2nd. Forward motion is obtained by means of a motor actuating a propelling instrument, in exactly the same way as in a steam-ship.

Speaking generally, the dirigible balloon is very like a submarine boat, as its flotation and forward motion are dependent upon almost exactly the same principles.

The main difference between them is, that while the submarine has to be designed to work both under and on the surface of water, the dirigible balloon is only required to travel through one fluid, viz., the air.

2.—*The Dimensions of Dirigible Balloons.*

The dimensions of this class of airship are difficult to determine, as they depend upon many variable factors, such, for instance, as the velocity, weight to be carried, and height at which the balloon is required to travel.

The following table gives the proportions of some of the principal dirigibles:—

TABLE I.

Dimensions of Dirigible Balloons.

Name.	Length.	Maximum Diameter.	Volume	Weight.	Horse-power.	Speed per Hour.	Remarks.
	Metres.	Metres.	cm.	kilg.		Miles.	
La France ...	50·42	8·40	1,864	2,000	$8\frac{1}{2}$	13	—
Santos Dumont, No. 6 ...	33·00	6·00	630	690	12	19·8	—
Zeppelin I. ...	128	11·66	11,578	10,050	I. 30 II. 170	18·	Aluminium.
Lebaudy I. ...	58	9·80	2,666	1,580	40	20	—
Italia	37·73	7·94	1,208	785	12	?	—

Speaking generally, a good dirigible balloon of the ordinary type, viz., silk or skin envelope, capable of ascending to a height of about 6,500 feet, might have the following dimensions:—

Volume—60,000 to 120,000 cubic feet.
Speed—20 miles an hour in calm weather.
Horse-power—30-H.P. to 60-H.P.
Total weight—About 63 lbs. per 1,000 cubic feet of volume.

3.—*Constituent Parts of a Dirigible Balloon.*

Various types of these balloons are shown in Figs. 1 to 8, Plate 1. While there is a great variety of design, the usual component parts, etc., are:—

a. The envelope, or bag holding the gas for lifting purposes.
b. The ballonet, or air bag for regulating the gas in the balloon.
c. The gas, usually hydrogen or coal gas.
d. The jacket, or net.
e. The suspension apparatus, for connecting the car to the jacket or net.
f. The car.
g. Fuel.
h. The motor.
i. The propelling apparatus.
j. The apparatus for steering in a vertical plane.
k. The apparatus for steering in a horizontal plane.
l. The apparatus for maintaining the equilibrium of the machine.
m. The rising and landing gear.
n. Miscellaneous fittings, such as lights, gauges for testing pressure of gas, photographic apparatus, etc.
o. Storage houses or sheds.

4.—*The Forces acting upon a Dirigible Balloon in Flight.*

In order to design a balloon of this class properly, it is necessary to clearly understand the forces acting upon it. These are: (See Fig. 9, Plate I.)

W = total weight of the whole machine acting at its centre of gravity.

A = total resistance of the air to forward motion, acting at C, the centre of pressure of the whole machine.

K = the lifting force of the gas, just balancing W, when the machine is moving on a level course.

P = propelling force.

The *Air Resistance* (A) is difficult to determine, and is best found by model experiments in a whirling table. Particular attention should be paid to finding the position of the centre of pressure, or point of application, of this force.

The lifting force (K) can be found approximately by calculation, its strength depending upon the weight to be lifted and the height to which the balloon is intended to rise. The formula for K is rather complicated, but if the balloon is required to reach a height of 6,500 feet, then—

$$K = V + \cdot 0629 \quad V = \frac{W}{\cdot 0629}$$

where V = volume of the balloon.
·0629 = density of air at 6,500 feet.
·0807 = ,, ,, ground level.

and

$$\text{Ascensional force} = V\,(\cdot 0807 - \cdot 0629).$$
$$= V \times \cdot 0176.$$

and the weight of hydrogen required = V x ·00559 lbs.

The point of action of K may be taken at the centre of figure of the balloon.

The *propelling force* (P) must of course equal the air resistance (A), its strength being calculated to overcome the maximum value of A likely to be met with. Owing to mechanical difficulties, the line of action of P is more or less fixed, and usually runs through some point in the car, but in a few balloons, such as Zeppelin I., it has been placed much higher, viz., on about a level with the line of action of A. This latter arrangement has some advantages, but the extra gearing required for the propeller is rather against it.

The *position of G*, through which W acts, is also difficult to ascertain; but it is clear that when A, K, and P are fixed, only one position of G will satisfy the conditions of equilibrium. These can be found as follows: (See Fig. 9, Plate II.) Combine A and K, forming the resultant Q, then the point where Q produced meets the line of action of P will be the proper position for G, and the weight of the whole dirigible must act vertically through that point.

The point G should fall within the limits of the car, as otherwise it is difficult to adjust the different forces suitably.

5.—*The Power Required for Propulsion.*

Since no power is necessary for lifting the machine, all that is required is to find the value of P.

Let V = proposed velocity of the balloon, A = maximum air resistance likely to be met with, then

$$P = A,$$

and actual horse-power required is

$$\frac{Av}{550}$$

The I.H.P. of the motor will, however, be higher than this, as usually only about 60 per cent. of the I.H.P. is effective. Consequently

$$I\,H\,P = \frac{Av}{550} \times \frac{10}{6}$$

6.—*Stability.*

There are two kinds of stability to be considered, viz.:—

a. Longitudinal.
b. Transverse.

Longitudinal Stability.—In the earlier dirigibles it was found very difficult to keep them on an even keel. The reasons for this were bad design, wrong adjustment of the suspenders, movements of the gas in the envelope, and quite unavoidable difficulties due to changes in the direction of the air force, alteration of balance by movement of passengers, etc.

For most of the troubles bad design was responsible; the centre of gravity of the machine was usually too far back, the result being that when the dirigible got into motion the front began to rise, and further progress was impossible. This can easily be seen from Fig 9, Plate I. If W and the vertical component of Q (when it is removed to the point G) do not act in the same straight line, a couple will be formed tending to raise the front of the balloon if K is in front of W, and *vice versa.*

Another source of error was the suspension arrangement. It is clear that if the car and balloon are not rigidly connected, as soon

as the motor begins to work the car will move relatively to the balloon and upset the balance. The best form of suspension is difficult to determine; it must be fairly rigid, but not absolutely so, as otherwise the envelope may be damaged when the propeller gets into action.

Most designers employ a system of suspension invented by Dupuy de Lome. (See Fig. No. 9, Plate I.)

Movements of the gas in the balloon are also a source of inconvenience, as the alteration in the position of the centre of gravity of the gas upsets the equilibrium of the machine. They are due partly to changes in the temperature of the air and partly to variations of the pressure in the envelope caused by changes in the speed at which the dirigible moves.

The best plan to stop these movements is to divide the envelope up into sections by partitions of unvarnished cloth, which only allow the gas to move through them slowly, and thus prevent any very rapid alteration of the position of the centre of gravity of the gas.

Alterations of trim caused by changes in direction of the air force can be provided against by keeping the centre of gravity well below the centre of pressure of the machine, or by using adjusting planes, etc., as described hereafter. The distance between the two centres above mentioned is difficult to calculate, but depends on the turning movement caused by any given air force, the line of action of which differs from that of the air force allowed for when the dirigible is travelling on a level course.

In a small machine, movements of the passengers upset the balance just as they do in a submarine, but in large dirigibles they are not of very much importance.

Transverse Stability.—This is a comparatively simple matter, for as long as the centre of gravity of the machine is well below the centre of pressure, no alteration of the air forces direction (which is the chief thing to be feared) is likely to upset a reasonably well-designed dirigible.

7.—*Constructional Details.*

The details of construction of dirigibles vary very much, but there seems to be a fair amount of agreement as to the general principles governing them; so the following notes may be found useful:—

Balloon or Envelope.

Since a considerable proportion of the air resistance is due to the balloon, it is of great importance to make it what is known as "fair shaped." The question of the best form for bodies and surfaces of any kind will be dealt with later on; consequently it is sufficient to say here that a spindle form, having a ratio of length to diameter of about 6 to 1 (the maximum diameter about 20 per cent. of the length from the front), appears to give the best results. Any form, however, proposed for use should be tested by model experiments, as there is often very considerable difference between the air resistance of forms which are to all appearances very much alike. Speaking generally, the air resistance of a well-shaped balloon should not exceed one-twentieth of the resistance to a plane surface having the same area as its maximum cross section.

As regards material, various stuffs have been used, such as varnished silk, cotton, skin, etc. The latter, used in the British

Service, appears to be the best, as it is extremely light and strong; it is, however, expensive,and consequently foreign countries seem to use silk or cotton varnished with some sort of india rubber solution.

The main point, of course, in connection with the material is its impermeability, viz., its power of holding the gas for considerable periods. In the early balloons this was a great difficulty, as most of the materials used were not at all gas-tight, and thus not only lost expensive gas, but also made the balloon flabby, increased the air resistance, and altered the equilibrium.

There should always be one or two layers of fireproof cloth on the underside of the balloon, to prevent hot gases from the motor setting fire to it.

Ballonet.

In order to keep the balloon tight and in proper shape, a "ballonet," or small balloon filled with air, is placed inside the main envelope. A special air pump in the car regulates the pressure in the ballonet, which in its turn increases or lowers the pressure of the hydrogen in the large balloon, and thus enables the proper shape to be maintained.

A recently built balloon—the Italia—has no ballonet, there being instead a very ingenious flexible arrangement of the underpart of the envelope, which allows automatic variation of the shape, according to the temperature and pressure of the outside air.

Gas.

Either coal gas or hydrogen can be used, but important dirigibles are filled with the latter, as although it is more expensive, its lifting power is much greater.

All the modern dirigibles have the hydrogen at a somewhat greater pressure than that of the outside air, the object being to retain the proper shape of the balloon under all circumstances.

Jacket or Net, etc.

Various means are adopted for connecting the car and the balloon, and the question is a difficult one. In some dirigibles a large cloth is fitted over the envelope, in others a net is used; but it cannot be said that either of these is very satisfactory, as they must from their nature have a rough surface, and consequently increase the air resistance. Santos Dumont did away with the jacket and used light wooden staves sewn into the fabric of the balloon; this seems a good plan for, at all events, balloons of medium size. The Lebaudys, on the other hand, fixed the flat bottom of the envelope to a fireproof cloth stretched over a metal framework, and this appears to have worked well; but there is no doubt that some better method of connection is much to be desired, and until it is arranged for, this will always be a weak point in dirigibles.

SUSPENSION APPARATUS.

Except in the case of the Lebaudys' balloon, some sort of ropes, cords, etc., are necessary to connect the car with the jacket, net, etc. Santos Dumont used piano wire fixed to the staves above mentioned, while other designers use silk ropes, etc. The main point to attend to

is that the ropes or wires should connect the car and the envelope as rigidly as possible, otherwise when the motor is in action, it will tend to move the car relatively to the envelope, and thus upset the equilibrium.

Various systems of suspension are shown in Figs. 1—8, Plate I.; most of them are more or less of the Dupuy-de-Lôme type.

In aluminium dirigibles (Zeppelin I.) the car is, of course, rigidly fixed to the framework of the envelope.

Car.

The car is now usually made in steel girder form, with a sort of box for the passengers to sit in, or else a kind of box formed of tubular framework and covered with fireproof cloth is used. It should be fair shaped to reduce the air resistance.

Fuel.

See Section II.

Motors.

These will be discussed in Section II.; but it is desirable to point out here that as far as possible the motor should be enclosed in some fireproof material, and that the exhaust or point of issue of hot gases should be so arranged as not to come near the envelope.

Propelling Apparatus.

See Section II.

Steering in a Horizontal Plane.

For this, rudders, like those of a ship, are used. They are generally constructed of tubular framework covered with cloth of some kind. On the whole, it seems best to place them at the rear of the dirigible, on a level about midway between the centre lines of the balloon or car. The rudders are, of course, worked from the car by a rope or chain.

Steering in a Vertical Plane.

In order to rise or descend without loss of gas, it is desirable to have rudders for steering, so to speak, up or down. These are usually in design similar to those described above, but fixed on an axis which allows them to move up and down from the normal horizontal position. When the rudders are inclined downwards the machine descends, when upwards it ascends. In the Lebaudy these rudders were fixed towards the rear, but it is probable that a better position would be in front, with the axis on a line about midway between the centre of car and centre of envelope.

Stability Apparatus.

As explained above, the maintenance of longitudinal stability is one of the great difficulties in connection with dirigibles. The various apparatus used are:—

Rolling weights;
Liquid balancers;
Adjusting planes;

and the system of "empennagement," suggested by the late Colonel Renaud, of the French Corps du Genie.

The rolling weights are masses of iron (running on a girder) which can be moved backwards and forwards, raising or lowering the front of the machine as may be found necessary. They are usually worked from the car by a rope or chain, and are, of course, rather a primitive kind of apparatus.

The liquid balancers are usually two tanks containing water, fixed one underneath the fore part of the balloon and one in the rear. A pump in the car pumps water from one to another as required, the pump itself being put in action by a pendulum, which starts it working whenever the inclination of the dirigible exceeds a certain amount one way or the other. Similar balancers are employed on submarines; the main difficulty is to get them to start and stop quickly enough.

Adjusting planes are surfaces of suitable size, fixed fore and aft, and worked by a rope from the car; with these also some form of pendulum arrangement for bringing them into action can be used.

The last kind of apparatus is that suggested by the late Colonel Renaud. His idea was to provide a sort of fish tail to the balloon, which, when any alteration of the position took place, forced the machine to return to its original position. The principle is, of course, the same as that which governs the flight of an arrow, the tail regulating the movements of the balloon in precisely the same way as the feathers regulate those of the arrow.

The idea is a very ingenious one, but the size of the tail, its position, etc., require to be carefully worked out, as if this is not done the balloon will act like a badly balanced arrow, and strain the car and envelope. It would probably be better to fix the fish tail in a line with the centre of pressure of the whole machine, instead of on the envelope itself.

As regards transverse stability, the best arrangement is to keep the centre of gravity well below the centre of pressure, but flexible side wings similar to those proposed for flying machines can also be used with advantage.

Rising and Landing Apparatus.

Rising can be managed in three ways, viz.:—

- Utilising the ascensional force.
- Throwing out ballast.
- Using special adjustable aero surfaces.

As already explained, when K is greater than W the balloon will rise, and this ascensional force comes into play when the balloon first starts from the ground.

Throwing out ballast, of course, decreases the specific gravity of the dirigible and causes it to rise; but it is not desirable to adopt this plan, as, once thrown out, the ballast is no longer available for use.

The special adjustable aero surfaces are curved surfaces placed for rising at a small positive angle with the horizontal. When the propeller is worked, the air acting on them gives a lifting force which helps to raise the machine. It should be noticed that as a balloon is only required to rise slowly, large aero surfaces are unnecessary.

Descending is managed by:—

- Letting out gas.
- Using the adjustable aero surfaces.

Letting out gas is, of course, a very undesirable method of descending, as the gas cannot be recovered. Sometimes, however, it

is necessary to do so, and special valves fixed in the envelope and worked by hand are usually provided for this purpose.

When using the adjusting aero surfaces for descent, the surfaces are fixed at a negative angle, and the air playing upon them forces the whole machine down. On the whole this plan seems to be the best; it has worked well in the Italia and the Lebaudy.

Miscellaneous Fittings.

These do not call for much comment, as they depend so much upon the class of work the balloon is intended for. For exploration, for instance, an acetylene search-light will be found useful; photographic and surveying apparatus are often desirable, and some form of electric light for illumination at night is generally provided.

As regards purely aeronautical fittings, small windows in both the balloon and ballonet for viewing the interiors are desirable, while gauges for checking the pressures of the hydrogen and air are, of course, absolutely necessary.

Storage House.

For large dirigibles a shelter is absolutely necessary, as if caught by the wind while being inflated or deflated, they are very likely to be seriously damaged. Usually a shed is built large enough to hold the inflated dirigible comfortably, and arrangements are made to enable it to be run in and out without danger.

The Zeppelin dirigible was housed on a raft on the Lake of Geneva; this was a very good plan, as the raft could be turned round as required, thus minimising danger from the wind when leaving or entering the shelter.

Workshops for repairs, etc., are usually attached to the storage house.

Some Recent Dirigibles.

[N.B.—Figs. 1 to 8, Plate I., are all to the same scale.]

Since 1892 a good number of dirigibles have been constructed; many of them were, of course, of little use, but the four following were fairly successful:—

Type A—Santos Dumont No. 6.
Type B—Zeppelin I. and II.
Type C—Lebaudy I. and II.
Type D—Italia.

A brief description of them will be of interest to those who contemplate constructing such machines.

Type A—Santos Dumont No. 6.

(1901. See Figs. 1 and 2, Plate I.)

M. Santos Dumont has constructed a great number of dirigibles, and been very fairly successful with them. He won the Deutsch Prize (100,000 francs) with his No. 6 in 1901

No. 6.

Balloon.—(*a*) Symmetrical, spindle-headed; length, 33 metres; diameter, 6 metres; volume, 630 cubic metres; the total weight of the machine, 690 kilograms.

Ballonet.—(*b*) Volume, 60 cubic metres, filled with air by a fan worked from the main motor, so arranged that air was always being supplied; excess of air escaped through a weak valve in the under part of the ballonet.

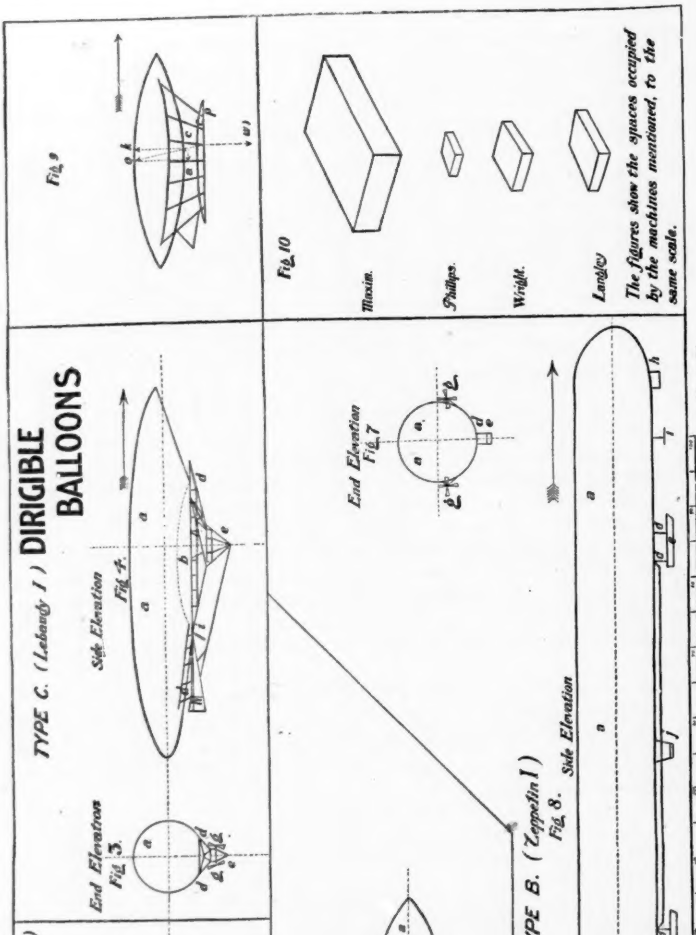

DIRIGIBLE BALLOONS
TYPE A. (Santos Dumont No. 6)
End Elevation
Fig. 1.
Side Elevation
Fig. 2
TYPE C. (Lebaudy I)
End Elevation
Fig. 3.
Side Elevation
Fig. 4.
Fig. 9
TYPE D. (Italia)
End Elevation.
Fig. 5.
Side Elevation
Fig. 6.
TYPE B. (Zeppelin I)
Fig. 8.
Side Elevation
End Elevation
Fig. 7
Fig. 10
Maxim.
Phillips.
Wright.
Langley
The figures show the spaces occupied by the machines mentioned, to the same scale.
Scale

PLATE I.

Gas.—Hydrogen, at a pressure of 30 kilograms per square metre.

Jacket.—(*d*) There was no jacket or net; the suspension cords were attached to wooden staves fixed in a seam sewn into the balloon along a line close to its equatorial.

Suspension Arrangements.—(*d*) Piano wires attached to the staves and the car.

Car.—(*e*) A sort of box-shaped steel girder; the willow basket for M. Santos Dumont to sit in was fixed in the girder about 3·60 metres from the front.

Motor.—(*f*) 12-H.P. Buchet type, 4 cylinders, and cooled by water round the top of the piston. Maximum traction power, 66 kilograms; this, at a velocity of 7·50 metres per second, gives about 6½-H.P. effective work, and an efficiency of motor, 54 per cent.

Propelling Apparatus.—(*g*) One two-bladed screw in rear; diameter, 4 metres; pitch, 4 metres; surface, 2 square metres.

Steering in a Vertical Plane.—(*h*) Triangular rudder in rear attached to one of the car suspenders, the ends being fixed to the bracket of the screw shaft and the envelope of the balloon.

Equilibrium.—This was maintained by a rolling weight worked from the car.

Landing and Rising Gear.—Besides the valve (*k*) in the ballonet, there were two valves in the rear of the lower part of the envelope. Ballast, 110 kilograms.

Storage House.—There was a good-sized shed for storage, well equipped with workshops, etc.

Trials.—This dirigible won the Deutsch Prize on 29th October, 1901; the course was from the Parc d'Aerostation at St. Cloud, round Eiffel Tower and return. The distance was about 16 kilometres, and was covered in 29 minutes 31 seconds; approximate velocity, 19·8 miles per hour.

Remarks.—While there was nothing very novel about this dirigible, the general results obtained were fairly good. The best points about it seem to have been the method of attaching the car to the balloon, and the arrangements for keeping the latter gastight. For small dirigibles, staves sewn in the cloth of the envelope appear to be very suitable, while as far as any ballonet system is satisfactory, M. Santos Dumont's seems to have worked well, as practically no gas was lost even 24 hours after the trials. The equilibrium seems to have been fairly good, but a rolling weight is not a really satisfactory solution of the question.

Type B.—Zeppelin I. and II.

(Patent No. 131, of 1898. See Figs. 7—8, Plate II.)

This is a very remarkable dirigible, as it is of great size and a good example of one with a metal envelope.

Zeppelin I.

Balloon.—(*a*) Aluminium frame and covering, cylindrical with conical ends; length, 128 metres; exterior diameter, 11·66 metres; interior diameter, 11·30 metres; volume, 11,578 cubic metres, divided into 17 compartments by partitions, all except two of which are 8 metres in length, these two (the fifth and thirteenth) being only 4 metres, to allow of the connections with the car being fitted to them. In each compartment, except the ends, there is a balloon (cotton, coated with india rubber) for the gas. The whole envelope was covered with a varnished silk jacket to protect it from the weather.

The partitions were constructed on the principle of a bicycle wheel, viz., having a small central circle connected with the 24-sided circumference by steel rods.

Ballonet.—None, as it is not necessary for a balloon having a rigid envelope.

Gas.—Hydrogen; to allow for expansion, only 97 per cent. of the volume was filled. Inflation was carried out from tubes—a separate lead to each compartment; time occupied, 14 hours.

Jacket.—None.

Suspension.—(*d*) The cars were fixed rigidly to the fifth and thirteenth partitions, the tubular framework being of aluminium.

Cars.—(*e*) Two in number, 6 m. long, 64 m. apart; boat-shaped tubular frames and connected by a girder.

Motors.—Two Daimler 4-cylinder motors of 15-H.P. each, one in each car; weight, without cooling water but including flywheels, 385 kgs., or at the rate of 26 kgs. per H.P. Only 50 litres of cooling water used; cooled by a pump which forced the water through 50 m. of aluminium tubing 28 mm. in diameter and 1 mm. thick; on the tubing were 88 radiators, each 82 mm. in diameter.

Propelling Apparatus.—Two 4-bladed screws, one in each car; diameter, 1 m. 15 mm., mean pitch angle, 18°; area (for 4 blades), 0·516 square m. Axes fixed at centre of pressure, viz., about half-way between centres of balloon and cars; when motor developed 30-H.P., about 71 per cent. of the power reached the screws; the probable total efficiency was 66 per cent. At 900 revolutions the thrust was 50 kgs., giving a speed of about 9 miles per hour; at full speed (about 18 miles per hour) the effective work was about 21-H.P., with a screw thrust of about 440 lbs.

Steering in a Vertical Plane.—One rudder (*h*), usually worked from the front car, but it could also be worked from the rear car. It was of tubular aluminium, framework covered with varnished silk.

Equilibrium Apparatus.—A moving weight (*j*)—150 kgs.—moving along the girder connecting the two cars, worked from the front car. There was also a horizontal rudder (*i*) in front 7 square metres in area, to preserve horizontal equilibrium.

Landing and Rising Apparatus.—Five valves in upper part of the envelope, 0·40 mm. in diameter, capable of letting out 4 to 5 cubic metres of gas per second; water ballast in reservoirs fixed all along the balloon.

Weights were as follows:—

	kilgs.
Balloon (except jacket and envelopes)	4650
Cars and suspension	680
Motors, flywheels, transmission gear, etc.	920
Propellers, axes, etc.	350
Condensing apparatus, reserve of essence, lubrication, etc.	480
Rudders	95
Girder	280
Moving weight, cables, etc.	175
Jacket and envelopes	1920
Valves	85
Five men	400
Ballast bags	15
Total	10,050

Storage House.—A large covered-in raft on Lake Constance; dimensions of shed: Length, 142 metres; width, 23·4 metres; height, 20·5 metres. The dirigible, when in working order, was floated in and out of the shed as required, and the shed itself could be turned round to suit the wind.

Trials.—Three trials were made of this balloon, but the results were not very satisfactory. At the last trial the machine was 23 minutes in the air, and with an 11 feet per second wind is said to have attained a velocity of 24·5 feet per second, or about 18 miles per hour

Remarks.—On the whole this dirigible was not a success. The main faults were want of strength in the balloon itself, which could not properly sustain its own weight or that of the moving weight, and doubtful stability owing to the centre of gravity being so close to the centre of pressure of the machine.

Zeppelin II.

This dirigible was very similar to Zeppelin I., the chief points of difference being:—

Envelope.—Length, 410 feet; diameter, 38 feet; volume, 367,120 cubic feet. There were only 16 compartments, and the total weight was slightly less, viz., 19,800 lbs.

Jacket.—Of very smooth silk stretched over a network of ramie, the object being to reduce the friction of the air.

Motors.—Two 85-H.P. Buchet motors, weighing about 390 kilograms, or at the rate of 1-H.P., 2·3 kilograms. The supply of benzine was sufficient for from 15 hours' to 24 hours' requirements.

Steering in a horizontal Plane.—Several superposed aero surfaces placed between the two cars. All these surfaces, as well as the rudders for steering in a vertical plane, were controlled from the front car.

Equilibrium Apparatus.—The rolling weight was done away with, and the equilibrium regulated by the superposed surfaces abovementioned.

Trials.—The first trial on the 30th November, 1905, was unsatisfactory, as the motor broke down before the airship was fairly started.

At the trial on the 17th January, 1906, the dirigible rose to a height of from 400 to 500 metres, and travelled about half-way to Friederichshafen; unfortunately when this point was reached the motors both broke down, and one of the superposed surfaces was displaced. This latter breakage upset the steering arrangements, and the dirigible eventually made a bad landing on some trees, being finally much damaged by an exceptionally heavy storm which occurred on the evening of the same day.

Remarks. — This dirigible was certainly better designed than Zeppelin I., and but for a series of accidents would probably have done fairly well. The accident on the 17th January showed the necessity for having proper land harbours for these large machines.

Type C.—Lebaudy.

(1903-1906. Patent No. 878 of 1903. See Figs. 3-4, Plate I.)

The Messrs. Lebaudy have constructed two dirigibles, and early in this year (1906) presented the best one (Type 1904) to the French Government for military purposes.

Lebaudy I. and II.

These two dirigibles were much alike, the latter being somewhat the larger, and a generally improved edition of the former.

Balloon.—(*a*) Spindle shaped, disymetrical both as regards length and diameter; length, 58 metres; largest diameter (at 24·90 metres from the front), 9·80 metres; volume, 2,666 cubic metres; surface of envelope, 1,300 square metres; weight of envelope, 550 kilograms; total weight, 1,580 kilograms.

Ballonet.—(*b*) Placed in centre of balloon, the lower part of it being fixed to the oval frame described later; capacity, 500 cubic metres, divided into three compartments and supplied with air by a fan (35 cubic metres per second) from the car, the connection being a short tube of canvas.

Ordinarily the fan is worked by the main motor, but there is also a small motor fed by accumulators for use in case of emergency.

Gas.—Hydrogen; maximum pressure in the main balloon, 35 millimetres; in the ballonet, 25 millimetres.

Jacket, etc.—None.

Suspension Arrangements.—(*d*) These are the principal features of this dirigible. The lower part of the envelope for a length of 16 metres is flat, and rests on the oval-shaped steel frame, to which the car is fixed. The frame itself is covered with fire-proof cloth, and as the under part of the envelope is of the same material, there are consequently two fireproof layers between the motor and the gas in the dirigible.

In rear of the oval plane a sort of movable tail formed of two girders is attached; this serves two purposes, viz., as a keel to prevent rolling, and as a kind of rudder to steer the balloon up or down when rising or falling. The rear of the envelope is stayed by guys to the tail. In order to prevent the wind getting between the oval frame and the envelope, the space between them is filled in with fireproof cloth.

Car.—(*e*) Fair shaped, 4·8 m. long; width, 1·60 m.; depth, 1 m.; tubular frame, covered with thin sheet aluminium. The tubes of the frame meet at a point underneath it, and the dirigible rests on this point when on the ground; 28 suspenders (steel), 5 to 6 mm. in diameter, connect the car with the oval frame; distance between car and oval frame, 3 metres. The front connection between the oval and the car is a rigid girder, the idea being to maintain the rigidity of the whole system of car and balloon.

Motor.—40-H.P. 4-cylinder Daimler, cooled partly by water circulation (20 litres) and partly by air radiation. The carburettor is on the Krebs system.

Fuel is carried in a cylindrical metal reservoir, with cone-shaped ends, placed underneath the car. Amount carried, 220 litres; 14 kilograms per hour or 300 grammes per H.P. hour; revolutions at normal speed, 1,000, but can be varied from 250 to 1,200; exhaust is under the car, and hot gases pass out through a funnel terminated by a wire ball.

Propulsion.—(*g*) Two 2-bladed screws; diameter, 2·44 m.; area of each blade, one-sixteenth of the screw circle; pitch variable, but mean pitch, 1·50 metres. The blades are of sheet steel, ½ millimetre thick, over tubular framework.

Steering in a Vertical Plane.—An ordinary rudder (*h*) fixed to the end of the vertical girder, its centre being about on a level with the oval frame, worked by cables from the car.

Steering in a Horizontal Plane.—Effected by movements of the tail (*i*), worked by cables from the car.

Equilibrium.—Maintained by means of two water reservoirs fixed one at each end of the oval frame, an automatic pump in the car connected with the reservoirs by flexible tubing being used to force the water from one reservoir to another as required.

Landing and Rising.—A manœuvring valve in the upper part of the envelope with safety valves in the main balloon and ballonet. Rising or descending is done by altering the inclination of the tail. There is no "tearing strip" for letting out the gas suddenly.

Miscellaneous Fittings.—Electric lighting service for ordinary illumination; 300,000 candle power acetylene search-lights, and trailing ropes, fire extinguishers, etc.

Storage House.—There is an elaborate shed with workshops, etc., for housing the dirigibles.

Trials.—A great many trials of these dirigibles have been made, both by the Messrs. Lebaudy themselves and officers sent by the French Government. On the whole, this type has been fairly successful, the maximum speed obtained is said to be a little over 20 miles per hour.

Remarks.—The chief novelties, of course, are the method of attaching the balloon to the car (by means of the oval frame) and the use of a tail for rising and descending. On the whole, both of these seem to have been fairly successful, but the system is complicated, and something simpler is much to be desired.

Type D.—Italia.

(1905. See Figs. 5-6, Plate I.)

This dirigible was constructed by the Italian Government, Count Da Schio being the inventor and designer.

Balloon.—(*a*) Spindle-shaped, the centre section circular, the two ends ogival shaped, the rear somewhat longer than the front; total length, 37·73 metres; diameter, 7·94 metres; surface, 710·2 square metres; volume, 1,208·4 cubic metres; weight, 203 kilograms. The chief novelty is the peculiar arrangement of the lower part of the envelope, which is made flexible, so that it can expand or close according as the temperature of the gas rises or falls, without sensibly altering the shape of the balloon. This expanding portion is made of india rubber, has a width of 1·40 metre, and area of 40 square metres; in the normal condition it can expand to 3·4 times its normal area.

Ballonet.—None, as the expanding portion of the envelope serves the same purpose.

Gas.—Hydrogen.

Jacket.—(*c*) Varnished cotton cover; length on the top, 27·49 metres; surface, 356·6 square metres. The jacket does not extend below the equator of the envelope; its weight, 55 kilograms.

Suspension. — 22 steel ropes (*d*), mean length, 5·75 metres; diameter, 2·7 mm. There are 175 eyelet holes on each side of the jacket for connecting the ends of the cables to the jacket.

Car.—(*e*) Is placed 4 metres below the lowest part of the envelope, square in section, and formed of tubular frame girders; length, 17·60 metres; sides of cross section, 1·20; covered with fireproof material so as to enclose all mechanism, motors, etc; four ventilators; three bicycle wheels are provided, two in front and one a little lower in rear; these allow of the machine resting comfortably on the ground. Material, chiefly aluminium tubing.

Motor.—12-H.P.; revolutions can be varied from 300 to 2,000 per minute.

Propulsion.—Twin screw propeller (*g*), 4·50 metres in diameter, in front of the car.

Steering in a Vertical Plane.—An ordinary type of rudder (*h*), area, 5·5 square metres, worked from the car.

Steering in a Horizontal Plane.—Two aeroplanes (*i*) fixed on a horizontal axis above the car; area of each, 10 square metres.

Equilibrium.—No special apparatus; generally maintained by the two aeroplanes above described.

Landing and Rising.—Managed by the two aeroplanes, but there is an automatic safety valve in the envelope.

Storage House.—A large shed with the usual workshops, etc.

Trials.—These have so far been chiefly for the purpose of testing stability, etc., as the motor was not sufficiently powerful to allow of any great speed being attained. A new motor is being fixed; estimated probable speed with the new motor, 7·50 metres per second.

Remarks.—This is a very ingeniously designed machine, and if the flexible envelope works satisfactorily after extended use, the management will be found a very convenient one. The main difficulty seems to be to find a flexible material which will stand the weather. For a dirigible of this size it is doubtful whether a jacket is necessary; the Santos Dumont system of suspension would appear to be sufficient.

Miscellaneous Remarks.

Many other types of dirigibles have been built or designed of recent years, but most of them have been failures, while the tests of the others have been so incomplete that it is hardly worth while describing them.

It is, however, desirable to allude to two types which are often advocated, viz., hot air dirigibles and dirigibles in which part of the sustaining power is got from aeroplanes.

As regards hot air dirigibles, M. Santos Dumont made some experiments in this direction, but the results were unsatisfactory. It seems to be impossible to make certain of keeping any envelope made of silk, skin, etc., properly extended in this system, as the changes of temperature and pressure of the outside air so affect the hot air that there is no certainty of regular action. It might be possible, by using a metal envelope, to obtain the necessary floating power, especially as part of the heating apparatus could be fixed in the envelope itself; but there are many constructional difficulties to be overcome, and it is very doubtful whether even in this case hot air could be used successfully.

The combination of balloons and aeroplanes is constantly advocated; but it seems to be forgotten that in order to get any lifting power from the aeroplanes, some considerable speed must be attained, say at least 25 to 30 miles an hour, and unfortunately it is just these high speeds which are so unsuited to balloons.

SECTION II.

Flying Machines.

1.—*General Characteristics.*

There are two kinds, viz.:—

a. Soaring machines,

b. Driving machines,

the former resembling generally sailing-ships, the latter steam-ships.

The chief characteristics of Class A are:—

1st. The weight is supported by the pressure of the air on a part of the machine called the "sustainer."

2nd. Motion in any direction is obtained by skilfully combining the force or the weight with the resultant air pressure on the whole machine.

No artificial power of any kind is required for this kind of flight, success being due to good shapes of body and sustainers and the skilful combination of the two forces above mentioned.

The chief characteristics of Class B are:—

1st. The weight is supported as explained for Class A.

2nd. Motion in a given direction is obtained by means of a propelling instrument worked by a motor.

In this class of flight artificial power is essential, but of course sailing flight can always be practised by this class when the artificial power is shut off.

It is not intended to discuss soaring machines in this paper, as, foı various reasons, they are never likely to be useful in practice. The following remarks, therefore, apply only to the true flying machine, or apparatus dependent for its movements upon artificial power.

2.—*Size, Weights, etc., of Flying Machines.*

The dimensions of flying machines are difficult to determine, and at present the best and most suitable sizes are largely a matter of opinion. The following table gives details of some of the principal machines recently constructed:—

TABLE II.

Showing principal dimensions, etc., of four typical flying machines.

Name.	Dimensions.		Weight.	I.H.P. of Motor.	Velocity miles per hour.	Remarks.
		Feet.	lbs.			
Maxim ...	Length	125	10,000			
	Breadth	104	3 passengers.	363	40	
	Height	40				
Phillips ..	Length	25	402	8·3	28	No passengers.
	Breadth	22				
	Height	11				
Wright ...	Length	42	925 lbs. (includ-	24	40	
	Breadth	46	ing 1 passenger			
	Height	12	= 145 lbs.)			
Langley ...	Length	64	830			
	Breadth	46	1 passenger.	75 (?)	30 (?)	52 B H.P.
	Height	16				

Speaking generally, it would seem desirable at present to construct machines as follows:—

1. For one passenger: Weight, 800 to 1,000 lbs.; velocity, 30 miles per hour; I.H.P., 20 to 25.
2. For two passengers: Weight, 1,000 to 1,500 lbs.; velocity, 35 miles per hour; I.H.P., 25 to 35.
3. Larger type for four passengers and 1,500 lbs. of stores: Weight, 7,000 to 10,000 lbs.; velocity, 35 to 40 miles per hour; I.H.P., 250 to 300.

No. 1 should be used very carefully, as the only passenger has to do all the work—steer, take charge of the engine, etc. The lying down position for the passenger is in this case essential, and special care should be taken to place all the controlling gear within easy reach of him.

No. 2.—A better class of machine, to be constructed after experience has been gained with No. 1. The lying down position for the passengers is essential in this case also.

No. 3.—Suitable for military reconnoitring work, etc. The 1,500 lbs. for stores would include a light gun for use against opposing flying machines, and a special class of gun with heavy shells for use against troops or ships.

3.—*Constituent Parts of a Flying Machine.*

Various types of these machines are shown in Figs. 1 to 9, Plate II.

The usual component parts are:—

a. Sustainers, or main supporting surfaces.
b. Suspension apparatus for connecting car to sustainers.
c. Car.
d. Motor, etc.
e. Propelling apparatus.
f. Apparatus for steering in a vertical plane.
g. Apparatus for steering in a horizontal plane.
h. Equilibrium apparatus.
i. Rising and landing apparatus.
j. Miscellaneous fittings.
k. Storage house.

4.—*The Forces Acting on a Flying Machine in Flight.*

These forces are very similar to those acting on a dirigible balloon, but are somewhat differently arranged. (See Fig. 9, Plate II.)

W = total weight.
A = resultant air force on the whole machine.
a = angle A makes with the horizon.
K = lifting force.
P = propelling force.

then—

$$K = W = A \sin a$$
$$P = A \cos a$$

As regards the forces themselves, the general rules given for dirigible balloons apply equally to flying machines. Special care should be taken to find the strength, line of action, and position of centre of pressure of A, as the value of a machine depends very largely on its correct estimation.

5.—*The Power Required for Flight.*

See "Dirigible Balloons."

6.—*Stability.*

The remarks upon the stability of dirigibles apply generally to flying machines; there being no gas in the latter, want of stability from this cause has not to be taken into account.

7.—*Constructional Details.*

As in the case of dirigible balloons, these vary very much; but the following notes will be found useful to those who contemplate constructing a machine.

Sustainers.

Roughly speaking, sustainers may be divided into two classes, viz., single surfaces and superposed surfaces. The single surface sustainers consist of large surfaces, flat or curved, such as that used in the Maxim machine. They are usually made of some kind of varnished cloth or canvas on steel framework for the sake of lightness. Great care should be taken to make them airproof, as if this is not done, there is apt to be a considerable reduction in the lifting power. The superposed surfaces are usually very narrow, and fixed in a frame one above the other, as was done in Mr. Phillips' machine. The best material for them seems to be wood, as it combines lightness with strength, and facilitates the construction of the peculiar shapes required in this class of sustainer. Examples of superposed sustainers are those designed by the Messrs. Wright (cloth or canvas) and Mr. Phillips (wood).

The shape of a sustainer is a very difficult matter to determine; but speaking generally they should be short (from front to back) the required area being obtained by making them very wide. In cross-section they should be of the form which gives the least resistance to forward motion for the maximum lift; most careful experiments should be made in a whirling table or other suitable apparatus to ascertain the best shapes and best angle of inclination, as quite small deviations from the best types often give most unsatisfactory results. As regards superposed sustainers, it seems to be fairly well proved that as long as the vertical height between them is from one to one-and a-half times their length from front to back, their lifting power is not reduced; that is to say, that under these conditions, six sustainers will lift six times as much as one of the same dimensions. The lift of sustainers and the resistance opposed by them to forward motion is difficult to calculate, and should, for any large machine, be ascertained by experiment in a whirling table; but the following table will give a good general idea of the power of certain kinds of sustainers for, at all events, preliminary calculations.

TABLE III.

Shewing the resistance (R) and lifting power (L) of surfaces one square foot in area at various angles of inclination:—

Angle of inclination.	Thin Flat Plane.		Lilienthal Curved Surface Curvature = $\frac{1}{12}$.	
	Lift L.	Resistance R.	L. Lift.	R. Resistance.
Degrees.				
−8	—	—	·000	·056
−3	—	—	·0841	·051
0	—	—	·152	·051
1	·035	·0006	—	—
3	—	—	·251	·055
5	·173	·0152	—	—
6	—	—	·381	·067
10	·332	·0585	—	—
12	—	—	·620	·115
15	—	—	·686	·130
20	·575	·2100	·740	·200
30	·693	·4000	·695	·356
36	·709	·5160	—	—
40	·697	·5860	·600	·483
45	·666	·6666	·540	·541

Notes.

1. The figures express the percentage which the lift or resistance bears to that of the same surface, moved perpendicularly through the air.

2. The pressure on the perpendicular surface is found from the formula.

$$P = \cdot 000166\ V^2\ S.$$

where P = pressure in lbs.
V = velocity in feet per second.
S = area in square feet.

3. The figures given for the Lilienthal curve are taken from Plate IV. of his book, "Der Vogelflug," and differ considerably from the figures generally used (Plate VI.).

It is not always understood that the Plate VI. diagrams were calculated from a too high value of P, and as a result give lifting powers much beyond the true values. The Plate IV. values were correctly worked out, and may be considered reliable.

4. The figures for a thin flat plane are from Duchemin's formula, and agree with Langley's experiments.

The use of the table is best shown by an example.

Example.—Find the lift and resistance of a flat surface 100 square feet in area, inclined at an angle of 10°, and moving with a velocity of 44 feet per second (30 miles per hour).

Here

$$P = \cdot 000166 \times 44^2 \times 100 = 320 \text{ lbs.}$$

and

$$L = \cdot 332 \times 320 = 106{\cdot}24 \text{ lbs.}$$
$$R = \cdot 0585 \times 320 = 18\ 72 \text{ lbs.}$$

Suspenders.

The framework for connecting the sustainers to the car should be very carefully designed, and arrangements made for providing struts, ties, etc., which are not only strong enough in the mechanical sense, but also offer the minimum resistance to the air when the machine is in motion. In most flying machines hitherto designed, this resistance is far too large, being often, with the car resistance, fully equal to the resistance of the sustainers, thus doubling the power required to drive the machine. Models representing the tubing, etc., used should, therefore, be very carefully tested in a whirling table, and only types oval, or at all events circular, in section made use of, as any square or oblong sections considerably increase the resistance.

The best material for the framework appears to be steel tubing, but wood can sometimes be used with advantage.

The Car.

While covered-in cars of fair shape are undoubtedly the most suitable, it is better in preliminary experiments to have open cars, which allow of the passenger seeing everything around him quite clearly. A simple framework of steel tubing with a small platform so arranged that the occupants can lie down comfortably at full length is really all that is required. Care should be taken to so fix all the controlling gear that it is easily reached by the passengers without moving about.

For covered cars, a fair shape should be adopted, as the "stream line" theory of Froude and Rankine shows that with shapes of this kind there is a very large reduction in the air resistance. The following table shows the resistance offered by certain fair-shaped forms, likely to be useful for cars (as also for balloons).

TABLE IV.

Showing the resistance (R) of certain forms, the cross section of which has an area = 1 square foot.

Plane	$= \cdot 001660\ V^2$.
Sphere	$= \cdot 000260\ V^2$.
Spindle shape ratio of L to Z = $\frac{2}{1}$ ..	$= \cdot 000130\ V^2$.
Spindle shape ratio of L to Z = $\frac{3}{1}$ ..	$= \cdot 000053\ V^2$.

Where V = Velocity S = cross sectional area.

Example.—Find the resistance to forward motion of a spindle-shaped balloon (2 to 1) when moving at a velocity of 44 feet per second; area of cross section = 1,000 square feet.

$S = 1{,}000$ square feet.
$R = \cdot 00013 \times 44^2 \times 1{,}000 = 251\cdot 7$ lbs.

As regards material, steel or wood framework, covered with fire-proof cloth or thin sheets of aluminium, appears to be the best arrangement; but great care should be taken not to make the car unnecessarily heavy.

Fuel.

In order to provide the "driving force," fuel or material capable of giving out heat (and consequently doing work) is necessary. Such fuel should be safe to use, have a good heat value, and be convenient to handle.

The commonest fuels are:—

Coal.
Coal gas, etc.
Liquid fuels.
Explosives.
Materials for producing electricity.

Coal, in its solid form, is the commonest kind of fuel, and is very largely used in steam engines. It has a fair heat capacity and is safe; but, on the other hand, it is bulky and troublesome to handle.

Coal Gas gives very satisfactory results in gas engines, but it is hardly likely to be much used for aeronautical work, as it must be compressed for stowage, and the extra weight of the cylinders used for this purpose would seriously interfere with its efficiency per lb. of plant. Acetylene gas, which has a good heat value, might possibly be used, as the water and the carbide need not be mixed until gas is actually required; but the use of acetylene in gas engines has not at present been properly developed.

Liquid Fuels: *Oil.*—This has been very satisfactorily used in various kinds of oil engines, and appears to be at present the best fuel for aeronautical work. It is safe, has a good heat value, and can be handled easily. It can, of course, also be used instead of coal in steam engines; but the most satisfactory results are obtained by exploding it in internal combustion engines of some type.

Different kinds of spirit fuels, such as alcohol, have also been used, and give good results.

Explosives.—These have always been a very favourite form of fuel with inventors. Unfortunately, however, they have many disadvantages; there is always a risk in handling them, their proper stowage is often a difficult matter, and their real heat value is not nearly so great as is popularly supposed to be. A pound of gunpowder and a pound of coal have, *when supplied with the necessary oxygen*, about the same heat value; but while the coal gets its oxygen, so to speak, free gratis from the air, the oxygen of the gunpowder is a constituent of the powder, and so much useless weight, as there is no means known at present of removing this oxygen and supplying the quantity required from the air when the powder is to be used.

Materials for Producing Electricity.—None of the batteries in use at present can be said to be at all satisfactory. They are *much too heavy*, and it must be said that while many inventors have tried to improve this class of fuel, none have succeeded in getting any really satisfactory results. A specially efficient type of cell may give 1 H.P. for, say, 40 lbs. weight, but most cells give much less, and any really powerful cells are almost always very troublesome to keep in order.

A good class of battery is much to be desired, as it would be the ideal form of fuel for aeronautical work; unfortunately, however, all the materials used at present give out heat (work) so slowly that any satisfactory results upon present lines seems very unlikely.

The following table will give an idea of the capacity for heat (and consequently for work) of the principal fuels in common use:—

TABLE V.

Fuel.	Heat value in British thermal units per lb.
Coal, good ordinary	14,000
„ Welsh steam	14,800
Coal Gas (London)	19,200
Acetylene Gas	20,745
Petroleum Oil, good ordinary	21,000
Alcohol, pure	12,100
Alcohol with 20 per cent. water	9,600
Alcohol, with 10 to 50 per cent. benzol	12,000
Gunpowder	1,115
Guncotton	3,213
Nitroglycerine	2,628
Dynamite 65 per cent. gelatine	2,376

N.B.—The British thermal unit = 778 ft.-lbs.

Motors.

The motor is a machine devised to utilise the power of the fuel to the best advantage. It cannot be said at present that there are any really good motors in existence, as even the best of them do not utilize more than about 35 per cent. of the power of the fuel, while the remaining 65 per cent. is not only wasted, but largely expended in more or less damaging the motor.

As regards possible improvements, the two worst losses, viz., the heat lost in the exhaust and loss by cooling, appear to be unavoidable. There are practical limits to the reduction of exhaust temperature, while in order to prevent damage to the cylinders, the use of some kind of cooling fluid to carry off excess (and consequently wasted) heat is essential.

The only really practical improvement appears to be a reduction in the weights. These are excessive, and there is no doubt that it is quite possible to construct motors equally safe and much lighter if the whole subject of their design is thoroughly considered.

The principal motors in ordinary use are:—

a. Steam and vapour engines.
b. Internal combustion engines.
c. Electrical engines.

Steam Engines have many advantages, as they are now well understood and easy to manage. A really first-class triple-expansion engine uses about $1\frac{1}{4}$ lbs. of coal per hour per I.H.P., the weight complete being as low as 40 lbs. per I.H.P. in special types.

Better results still can be obtained from an engine of the Maxim type, these use naphtha instead of coal; consumption, ·8 lbs. per I.H.P.; weight, 10 lbs. per I.H.P.

As regards turbines, they require more fuel than the ordinary type of engine, but their weight is somewhat less.

As regards vapour engines, many efforts have been made to try and utilise some of the heat lost in steam engines by vapourising,

ether, ammonia, etc., but the results have not been found satisfactory owing to leakage of the vapour, and the complications introduced by trying to combine two different systems of working.

On the whole steam engines are unsuitable for aeronautical work, as they are too heavy and require too much fuel for the effective work they do.

Internal Combustion Engines.—In these the oil, gas, spirit, etc., is mixed with air, and exploded by electrical or other means, the force of the explosion being used to drive a piston, as in steam engines.

As regards the gas engine of the ordinary type, it is efficient, as the best ones utilise fully 30 per cent. of the heat of the fuel, but unfortunately the weight of the tubes in which the gas is compressed for carriage, is so great that this kind of motor is unsuitable for aeronautical work. There is also considerable difficulty in keeping them cool, and the weight of cooling water required is another important defect.

Gas turbines would, of course, be still lighter than the ordinary type of gas engine, but they are not at all satisfactory at present. Suitable arrangements for compressing the gas before explosion are difficult to provide, and the weight of the cylinders for stowage in this case also is against their use.

Oil and spirit engines, on the whole, appear to be the most satisfactory, as they are comparatively light, use only a moderate amount of fuel, and the latter can be stowed in a small compass.

The chief objection to them is the difficulty of keeping them cool; when cooled by water a large quantity of fluid is required, and the weight is materially added to, while air cooling alone does not seem to be sufficient. The best plan appears to be a combination of the two, viz., surrounding the cylinder with water, circulated by a pump, through the tubular framework of the flying machine and cooling the water by means of air radiators fixed at convenient places.

The weight of these engines depends largely upon their speed of rotation, and the number of cylinders employed, the lightest engines having usually the greatest number of revolutions and cylinders. Complicated high speed engines of this kind are, however, very difficult to manage, and consequently moderate speeds and a limited number of cylinders, give the best results in practice. Oil and spirit turbines are now being tried, but they are not sufficiently advanced at present to give satisfactory results.

Electrical Engines.—These are, of course, the ideal engines for aeronautical work, but unfortunately the types now in use are far too heavy. If an oil, or steam engine is used to work a dynamo, it is obvious that the final efficiency of the system will be less than that of the oil or steam engine alone, and consequently, this kind of electrical generation is out of the question. Batteries, as already explained, are much too heavy, and until some much lighter type of motor and fuel is discovered, there is not much prospect of being able to use electricity for aeronautical work.

Weights and Fuel Consumption of Motors.—It is not very easy to give definite information on these points, but the following notes may be found useful.

Steam Engines (Maxim Type).—W., 10 lbs. per I.H.P.; fuel, ·8 lbs. naphtha per I.H.P. per hour.

If a turbine be used, W would be about 20 per cent. less, but the fuel consumption would probably be 10 per cent. more.

Oil and Spirit Engines.—W., as low as 4 lbs. per I.H.P.; fuel consumption, about the same as above.

Electrical Batteries.—W., 40 lbs. per I.H.P.

Propelling Apparatus.

In order to obtain the "driving force" it is necessary to use some form of "propelling apparatus."

The principal ones are:—

Jet.
Paddle.
Screw (wing or marine type).

All these instruments work upon the same principle, viz., they drive a certain mass of air astern, at a certain velocity, and thus obtain a reaction from the surrounding air, which drives the machine along.

The power of propellers is very difficult to calculate, as it depends upon their position relative to the machine propelled, their form, and the power applied to them. The shape of the propeller is, of course, the most important item, but it is unfortunately very difficult to settle, as there is at present no satisfactory means of finding the weight of air driven astern, or its velocity. The best plan appears to be to consider the blades as flying aero surfaces, moving under certain known conditions, and to then calculate the thrust and resistance from the general rules given above for the lift and resistance of such surfaces. The best position of the propeller relative to the machine is also difficult to determine, but the general rule is to place it so that it works as much as possible in undisturbed air, an arrangement which does not usually present much difficulty in a flying machine.

As regards the different types of propellers, the jet and paddle are unsuitable for aeronautical work, as the former requires a large amount of material to obtain a given thrust, while the latter is very unwieldy and difficult to manage and construct.

Of the screw type, the wing class or bird shaped machine is objectionable, as, if the wings (which it must be recollected are required to support as well as to drive) in any way fail, disaster is certain.

By far the best form is the ordinary marine type, as it is very fairly efficient, and if by any chance a breakage occurs, the safety of the whole machine is not endangered.

The efficiencies of the marine type, allowing for losses, such as bad position, shape of the screw, etc., may be taken as follows:—

Inferior	50 per cent.
Medium	60 ,, ,,
Good	70 ,, ,,
Very good	80 ,, ,,

of the power applied to the screw.

Steering in a Horizontal Plane.

See remarks on "Steering of Dirigible Balloons."

Steering in a Vertical Plane.

See remarks on "Steering of Dirigible Balloons."

Stability Apparatus.

The remarks on the apparatus required for dirigible balloons apply generally to flying machines, but as there is no gas to upset the balance, the provision of suitable arrangements is simpler; generally speaking, as regards longitudinal equilibrium fore and aft aero surfaces, controlled by springs, pendulums, etc., are the most suitable, while for transverse equilibrium, similar aero surfaces fixed on each side of the machine appear to be the best. In any case, the centre of gravity should be well below the centre of pressure of the whole machine, as this of itself considerably assists the maintenance of the equilibrium.

Rising and Landing Apparatus.

Although in some machines special appliances, such as inclined planes, springs, etc., are used to assist in rising from the ground, it is much better to do without them.

The true flying machine must be able to rise by its own unaided power, as any special apparatus of the kind above-mentioned seriously limits its value, and adds to the cost of its construction. The best plan is to have specially prepared, smooth rising tracks, along which a machine can be run under its own power, the rise being effected when the velocity required to produce the necessary lifting power has been reached (see storage, etc.).

As regards landing, this is best done by regulating the descent with the aero surfaces for steering in a vertical plane. The machine is, so to speak, steered downwards, the great object being to steer it in such a manner, that the car will be in a horizontal position, when the ground is reached (see storage, etc.). It is desirable in experimental machines to use springs, buffer posts, etc., to check the shock of a bad landing.

Miscellaneous Fittings.

See remarks on "Dirigible Balloons."

Storage Houses, Workshops, etc.

As in the case of dirigibles, good store houses, workshops, etc., are desirable, but in addition to these, a large open space or land harbour is absolutely necessary in order to start and descend in safety.

The land harbour should be a perfectly smooth open plain, say 1,000 yards long by 500 yards wide, with one prepared track about half-mile long, for experimental tests, and a number of smaller ones for rising, about 100 yards in length. All obstacles, such as trees, hedges, etc., should be cleared away, and care should be taken to so manage the various workshops, etc., that they do not interfere with the aerial manœuvring.

8.—*Some Typical Flying Machines.*

[N.B.—Fig. 10, Plate I., shows the approximate size of the four machines to the same scale.]

A great number of flying machines have been constructed since 1892, the most important ones being:—

Type A.—Maxim.
Type B.—Phillips.
Type C.—Langley.
Type D.—Wright.

A brief account of them will, therefore, now be given:—

Type A.—Maxim.

Patent No. 10228 of 1891 (see Fig. 1, 2, 3, Plate II.).

General Dimensions.—Length = 125 feet, breadth = 104 feet, height = 40 feet, total weight fully loaded with 3 passengers = 10,000 lbs. The lift per square foot = $2\frac{1}{2}$ lbs.; per I.H.P. = $\frac{10000}{363}$ = 27 lbs.

Sustainers.—These consisted of a large central sustainer, with a sort of small tail, (*a a*), and side wings (*b b*), which acted partly as sustainer and partly as equilibrium apparatus. The main sustainer was 50 feet wide by 60 feet long; area, 3,000 square feet. It was constructed of tubular frame, with a double canvas covering, the curvature being about $\frac{1}{18}$; angle of inclination = $\frac{1}{8}$. The wings, ten in number (only four of which were used at the trial), were each 38 feet long by 6 feet wide; area, 228 square feet, and the total sustaining surface at the trial was, therefore, about 4,000 square feet. The construction of the wings was similar to that of the main sustainer.

Suspension.—The car was attached to the sustainers by an elaborate steel tubular framework, the general design of which can be seen from Figs 1, 2, 3 (*c c c*).

The Car (*d*) was a simple platform 40 feet long by 8 feet wide, constructed of steel tubing with wooden flooring. It carried the three passengers, motor, stores of fuel, etc.; the condenser was in the front part of the main aero surface or sustainer.

The Motor (*e*) was a 363 I.H.P. steam engine, fired by naphtha fuel (of 72° B.). The boiler was of the water-tube pattern, heating surface, 800 square feet, the steam pressure being 320 lbs. per square inch; weight about 1,000 lbs. The compound engines weighed about 700 lbs., and had a piston velocity of about 750 feet per minute. The exhaust was led out through the frame of the machine, so as to minimise danger from fire. The condenser was fixed in the front part of the main sustainer, but at the time of the trial had not been fully worked out. The total weight of the motor, viz., boiler, engines, condenser, etc., was about 10 lbs. per I.H.P.

Propulsion.—There were two 2-bladed propellers (*f*), diameter, 17 feet 10 inches; pitch, 16 feet. They were made of wood, in slips like the sticks of a lady's fan, and turned down to shape. The thrust given by the four blades = 2,000 lbs. when engines were running at 375 revolutions per minute.

The efficiency was about 60 per cent.

Steering in a Vertical Plane.—This was effected by means of fore and aft rudders (*g g*), connected by wire guys, controlled from the platform.

Steering in a Horizontal Plane.—This was managed by running one screw faster than the other, a special apparatus being fixed on

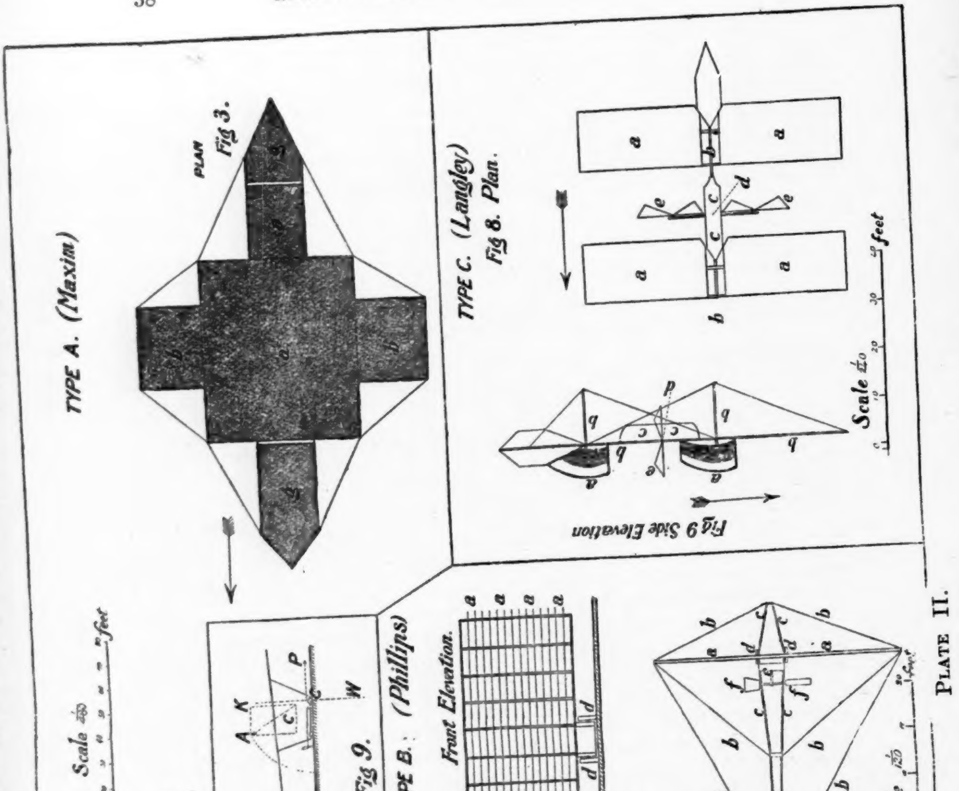

TYPE A. (Maxim)
PLAN
Fig 3.
Side Elevation.
Fig 1.
Front Elevation
Fig 2.
TYPE B. (Phillips)
Fig 4.
Front Elevation.
Fig 9.
Fig 5.
PLAN
TYPE C. (Langley)
Fig 8. Plan.
Fig 9 Side Elevation
TYPE D.
(Wright)
Fig 6.
PLAN
Fig 7. SIDE ELEVATION
feet

PLATE II.

the screw shaft to allow of this being done. There would, of course, have been no difficulty in using an ordinary type of rudder, if it was considered desirable to do so.

Equilibrium Apparatus.—As regards longitudinal equilibrium, it was intended to use a gyrostat, controlling the fore and aft rudders, but this had not been fixed at the time of the trial. Transverse equilibrium was secured by the inclined wings (*b*), and by the fact that the centre of gravity of the machine was well below the centre of pressure.

Rising and Landing Apparatus.—The wheels of the car ran along a 9 ft. gauge railway track. To rise from the ground, the machine was simply run along the track under its own steam, and was intended to rise when a velocity of about 35 miles an hour had been attained.

Landing was managed by slacking off the power and then by means of the fore and aft rudders reaching the ground with the platform, level, the friction of the ground with the wheels, of course, soon bringing the machine to a standstill.

Miscellaneous Fittings.—There were various ingenious apparatus for testing the lifting power of the sustainers, etc. For about a quarter of a mile along the track there was a sort of inverted track above the one previously mentioned, with which special wheels on the machine, some 30 feet apart (*j*), engaged.

When the machine began to lift, these latter wheels came into action, and by means of dynographs, the amount of lift in front and in rear could be ascertained.

Storage.—There was a large storage house, with suitable workshops, close to the railway track, and the machine could be run out by its own steam.

Trial.—The principal trial took place on 31st July, 1894. The machine, with four wings in position, was run along the track under its own steam. After about 500 feet had been traversed, the speed being about 40 miles per hour, it began to lift, and for a further distance of about 400 feet actually flew, the wheels of the 9 feet gauge being quite off the track. Unfortunately at this moment the rear outrigger of the upper wheels doubled up, not being strong enough to bear the lifting strain, and this, of course, wrecked the machine as other parts broke and the upper track itself became disorganised. The accident is much to be regretted as there is no doubt that this very large machine, weighing some 5 tons, actually did fly for a short distance, and in all probability would have proved fairly successful had the accident not taken place.

Remarks.—This machine was a very remarkable one, and its design, especially the manner of strutting and tying the sustainers, should be carefully studied by aeronauts. Probably it would have been better to have experimented with a smaller machine, one of, say, 1,500 lbs. to 2,000 lbs. in weight, as this would have been easier to construct. Nowadays, of course, one of the new light oil engines would probably be used instead of a steam engine, but the one designed was a most ingenious one for the period, and extraordinarily light for the power developed.

The accident on the 31st July, 1894, was most unfortunate; there is little doubt, that if free flight had been tried, the results would have been very fairly successful.

Type B.—Phillips.

Patent No. 13768 of 1884
Patent No. 20435 of 1890 } See Figs. 4, 5 Plate II.
Patent No. 13311 of 1891

General Dimensions.—Length, 25 feet; breadth, 22 feet; height, 11 feet; total weight, including 72-lb. load, 402 lbs. It was not intended to carry a passenger, but to show the principles of Mr. Phillips' invention. Lift per square foot, 3 lbs., and per I.H.P., 48 lbs.

Sustainers.—These consisted of 50 wood slats, something like the slats of a Venetian blind in shape, fixed in a steel frame, 22 feet long by 9½ feet in height. The slats themselves were 22 feet long, 1½ inches wide, curved in section to the peculiar shape advocated by Mr. Phillips. The area of the sustaining surface was 136 square feet, the slats being slightly inclined when the machine was in motion; total weight of the sustainers, 70 lbs.

Suspenders.—The sustainer was fixed to the car by wire guys, (*b b*), care being taken to have the frame truly vertical.

Car (*c*).—This was a sort of skeleton framework formed by two planks on edge. Just under the sustainer the planks were 3 feet apart; in rear the distance was 1½ feet, while in front the space between them allowed of the front wheel (*d*) working easily in it. There were two other wheels (*d*), 1 foot in diameter, under the frame; weight, 60 lbs.

Motor (*e*).—An 8 to 9 I.H.P. compound steam engine, with coal fuel. The boiler was of phosphor-bronze, 1 foot in diameter and 1¼ feet in height. Steam pressure, 180 lbs.; revolutions, 400 per minute. Total weight, with fuel for about half an hour, 200 lbs.

Propulsion. — One 2-bladed screw, wing-shaped, in section; diameter, 6 feet; pitch, 8 feet; projected area, 4 square feet. The thrust, standing still, was 75 lbs., and was probably about 70 lbs. when in motion. The B.H.P. was about 5 H.P., and the efficiency of the whole about 60 per cent.

Steering in a Vertical Plane.—There was no arrangement for this; see trials below.

Equilibrium Apparatus.—See trials below.

Rising and Landing.—See trials below.

Trials.—As it was not possible to put a passenger in the machine to control it, it was attached to a central post by wire guys and run round in a circle of 100 feet in diameter. The track consisted of wooden planking about 4 feet wide. The apparatus was started under its own steam. As the velocity increased, the pressure of air under the slats caused it to rise some 2 feet or 3 feet above the track, finally coming down again when the velocity fell off. The longitudinal equilibrium was found by trial, viz., shifting the weights until the machine moved level.

The best trial seems to have taken place on 19th June, 1893, when, with a speed of 40 miles an hour and load, 385 lbs., all the wheels were off the ground for about 1,000 feet of the distance traversed. The pitch of the propeller had been slightly reduced for this trial; it was noticed that when flying the slats appeared to be very nearly horizontal.

Remarks.—This was a most ingenious machine, and although only a large model, is well worthy of careful study. Its chief merit lies in the arrangement of the slats in a frame, as this class of design not only provides great lifting power, but also, owing to there being no large surfaces to strut and guy, immensely simplifies the constructional details. It is much to be regretted that further experiments were not made with it, as it appears to be the best of all the types which have been tried during recent years.

Type C.—Langley.

(See Figs. 8—9, Plate II.)

Professor Langley constructed several machines at different times, but the most important were the full-sized one tried towards the end of 1903 and its quarter-scale model.

The Model (1903).

General Dimensions.—Length, 16 feet; width, 12 feet; height, $4\frac{1}{2}$ feet; weight, 58 lbs. Lift was ·9 lb. per square foot of supporting surface, and from 16 lbs. to 18 lbs. per I.H.P.

Sustainers.—Four wings (*a a*), having a surface of 66 square feet, inclined at an angle of about 12°; curvature was about $\frac{1}{8}$, the highest point being at about one-third the width from the front.

Suspenders.—A tubular backbone (*z z*), strutted, and guy, to which was attached the car and wings.

Car.—A boat-shaped body with tubular frame and sheet metal covering, containing motor, fuel, etc. (*c*).

Motor.—Gasolene, $2\frac{1}{2}$ to 3 I.H.P. (*d*).

Propulsion.—One 2-bladed screw 3 feet 4 inches in diameter (*e*).

Steering.—This was arranged for by using a rudder (*f*), having a vertical surface for right and left movements and a horizontal surface for up and down movements. The best position to keep the model level was apparently found experimentally, and the rudder was fixed in that position when the trials were about to take place.

Equilibrium Apparatus.—No special apparatus, but the inclination of the wings was sufficient to ensure transverse stability. Longitudinal stability was apparently found experimentally, the rudder being shifted about until the machine balanced.

Rising and Landing.—It is not quite clear how the rising was managed. Professor Langley fully realised that much greater power was required for starting than when in the air, and used some sort of springs for, so to speak, firing off the model at the start, but no details of the apparatus have been published.

There was no special landing apparatus, the model falling to the ground, or rather water, when the power of the engine was exhausted.

Trials.—On 8th August, 1903, trials took place. When launched from the top of a house-boat, some 20 feet above water level, the model flew directly into the face of the wind on an even keel, both longitudinal and transverse stability being very satisfactory.

No very long flights were attempted; the actual details concerning them have not been published.

Remarks.—The model flew fairly well; the lifting power, however, seems to have been rather small owing probably to the steep angle of inclination of the wings. It could hardly also be called a true flying machine, as extra power from springs was used to start it.

The Full-size Machine.

The general design of this was exactly the same as that of the model, but the following details may be found of interest:—

General Dimensions.—Length, 64 feet; breadth, 46 feet; height, 16 feet; total weight with one passenger, 830 lbs.; lift per square foot of sustaining surface, ·8 lbs.; per B.H.P., 16 lbs.

Sustainers.—Area, 1,040 square feet.

Motor.—52 B.H.P., 5 cylinders with balance weights; vibration very small. Weight of motor with cooling water, battery, etc., was less than 5 lbs. per B.H.P.

Trials: 7th October, 1903.—The machine was started from the top of the house boat as described in the case of the model; unfortunately, just as it was leaving the track it was pulled down in front by part of the launching apparatus and carried into the water.

8th December, 1903.—A further trial was made, but in this case also part of the launching apparatus struck the machine as it was leaving the track, and the damage done was so great that no further experiments were carried out.

Remarks.—The failure on both occasions of the launching apparatus was most unfortunate, as Professor Langley never really got a chance of showing what his machine was capable of. The lifting power was, as in the case of the model, indifferent. Such a powerful motor should have given better results, but no doubt the defective shape of the sustainers was responsible for this.

Type D.—Wright.

(Patent No. 6732 of 1904. See Figs. 6—7, Plate II.)

The actual details of the machine invented by the Brothers Wright have not been published, but it is understood that it is very similar in design to their "soaring machine," plan and side elevation of which is given in Plate II., with the addition of a motor.

General Dimensions.—Length, 42 feet; width, 46 feet; height, 12 feet; total weight (including operator, 145 lbs.), 925 lbs.; lift, 1·9 lb. per square foot, 38 lbs. per I.H.P., at about 40 miles per hour.

Sustainers (a a). — Two wide superposed surfaces, 40 feet by 6 feet; vertical height between them, 6 feet. The two sustainers are constructed of wood frames with canvas stretched over them, and connected by vertical posts strutted and stayed by guys of piano wire.

Suspenders.—There is no regular car but there is a platform (*b b*), to which the lower sustainer is fixed.

Car.—A platform (*b b*) on which the passenger lies, his head being immediately below the vertical steering rudder or guiding plane.

Motor.—24 I.H.P. gasolene 4-cylinder 4-cycle explosive engine; weight, 250 lbs.; position vertical about half-way between the two sustainers, above centre of lower sustainer (not shown on plan).

Propulsion.—Two chain-driven screw propellers, from 10 feet to 15 feet apart in plan (not shown on plan).

Steering in a Vertical Plane.—Two guiding planes or rudders (*d*), the angle of which can be altered as required by means of the pulleys (*e*).

Steering in a Horizontal Plane.—A vertical rudder (*c*), worked by cords or ropes. This rudder can be made to rise up about a foot, so as to prevent it being damaged if a bad descent is made.

Equilibrium Apparatus.—By means of the pulley (*f*) and the cords (*g*), the angle of inclination of the outer parts of the sustainers can be increased or decreased as required, thus enabling the operator to counter-balance the effect of sudden gusts of wind. The pulleys and cords are put into action chiefly by movements of the operator's body, and there is a connection between the cords (*g*) and the rudder (*c*) which allow of the latter always acting in consonance with the twist of the sustainers.

Rising and Landing.—The machine rests on a small carriage which runs on a single-rail track some 40 feet long, raised about 6 inches above the ground. Coming out of the shed with its own power, assisted by two men to balance it, it runs along the track and rises in the air when a distance of about 20 feet has been traversed.

Landing is effected by using the guiding planes, the machine coming to the ground with a moderate velocity, and stopping as soon as its momentum is expended.

Trials.—A great number of trials have been made during 1905, some of them very successful ones. The best one appears to have been on the 5th October, 1905, when a velocity of some 40 miles per hour was attained, the trip in the air (which was on a circular course) having lasted 36 minutes.

Remarks.—There is no doubt that this is a very remarkable machine; it has been frequently tested, and the results have in nearly every case been very satisfactory. The lifting power seems rather poor, and it is extremely doubtful whether the arrangements for maintaining the equilibrium are suitable, as it does not seem desirable to in any way tamper with the sustainers, which, it must be recollected, are the real supporters of the machine during its flight. It would seem better to use some form of side wings to maintain the transverse equilibrium, as this can easily be done and is very effective.

Another important point to note is, that considerable skill is required to work the machine—far more than would be required to drive a motor car, and as this skill can only be attained by long and constant practice (as the Messrs. Wright found), the use of such a machine is only open to very highly-trained aeronauts. Some simpler form of apparatus will be required before flying machines can come into general use.

Miscellaneous Remarks.

A great many other machines have been designed during the last 15 years, but they have seldom given promise of success. M. Santos Dumont, M. de Vaux, and others are now building machines, but as yet very little information is obtainable about them, and as far as can be judged at present no very satisfactory results have been attained.

SECTION III.

The Present Position of the Aerial Navigation Question.

This may be summed up as follows:—

1.—*Dirigible Balloons.*

On the whole, the dirigible balloon does not seem to be a very satisfactory solution of the problem of flight. It must be of considerable size in order to carry any reasonable weight, its speed is limited, and there are many difficulties in connection with its construction and management. It also, contrary to popular ideas, requires some sort of land harbour for starting and alighting, and cannot rise and descend at any time and anywhere as is usually supposed.

Taking one thing with another, I believe it would be better to stop the construction of dirigibles altogether, as the cost of building them is not commensurate with the results obtained.

2.—*Flying Machines.*

The flying machine appears to be far the best solution of the question. There is now no reason why good serviceable machines, travelling at the rate of from 30 to 40 miles per hour should not be constructed, and although the experiments necessary to ascertain the resistance of the air are somewhat costly, still the machines themselves need not be very expensive; no more so, in fact, than a good motor car, or carriage and horses.

The question of safety is, of course, of the first importance, but I do not myself think that a well-designed flying machine is a bit more dangerous than a dirigible balloon; in fact, in some ways it is safer.

3.—*The Flying Machine in War.*

There is no doubt that in the next great war flying machines will be regularly employed. The purposes for which they are likely to be used are:—

a. Against other airships.
b. Against sea forces.
c. Against land forces.

As regards purely *aerial warfare*, the first object of each side will be, by means of their air forces (forces distinct from the land or sea forces), to obtain the command of the air. For this purpose both sides will maintain high-speed flying machines, armed with light guns, for use against opposing airships, and well supplied with fuel, so that it will not be necessary for them to return to their bases (land or sea) for considerable periods. The aerial battles will practically settle the first period of the campaign, the victor gaining the command of the air and all the advantages which will ensue therefrom.

Against an enemy's *sea forces* the flying machines will chiefly be used for reconnoitring purposes to ascertain the number and quality of the ships, etc.; but it seems probable that efforts will also be made by firing specially designed projectiles more or less vertically downwards on the decks of ships to seriously damage the engines, boilers, etc., of the floating vessels. No doubt the flying machines will have

considerable difficulty in carrying out this duty, but it seems probable that light, high-speed machines, painted so as to resemble the sky as much as possible, will be able to do a great deal of damage, though no doubt their own losses will be serious. The location and destruction of submarines will possibly also be an important function of the aerial ship, as their position high up in the air will enable them to trace the course of vessels some 30 feet or 40 feet below the water, as explained by M. Santos Dumont in his book "My Airships."

Against the *land forces*, reconnoitring will be the principal duty, but setting fire to store depôts and attacking mounted troops in formed bodies, and stampeding or destroying their horses will also be practised.

4.—*The Commercial Flying Machine.*

At present it is doubtful whether the flying machine is suitable for commercial purposes, as transport by rail or ship is probably cheaper; but there seems to be an opening for postal and light parcel work, and when more experience has been gained and airships with a higher speed are available, it should be quite possible to convey passengers and light goods at a rate ensuring a reasonable return on the expenditure involved.

5.—*The Flying Machine in Sport.*

It is somewhat surprising that in a sporting country like Great Britain little or no attempt should have been made to navigate the air with dirigible balloons or flying machines as an amusement.

Aerial navigation in either ordinary or racing airships would undoubtedly be a pleasant and exciting form of travel, and it is greatly to be hoped that those who have the leisure and money for experimental work will take the subject up.

Concluding Remarks.

In conclusion, I particularly desire to bring to notice the enormous importance of this subject, and the necessity for its careful investigation. There is no doubt whatever that aerial ships will play an important part in future wars, and it is consequently most desirable that this country should at once take steps to ensure a suitable aerial force being ready when the time for the struggle arrives.

As regards the investigation of the subject, I suggest that a Royal Commission be appointed to report, after careful enquiry, as to whether there is now a reasonable chance of solving the problem of flight. The members of the Commission should be aeronauts, military officers and mechanical engineers interested in the subject, and should examine (if necessary, confidentially) any persons who desire to give evidence before them. Their final report ought to be a definite one, and while not recommending the proposals of any particular inventor, it should state clearly what the immediate prospects of the solution of this important question are.

It is obvious that the report of a well-selected body of scientific men would be of great interest to the general public, and might possibly act as an inducement to commercial men and others to take the subject up from the purely civilian point of view.

APPENDIX I.

List of Journals, etc., giving useful information regarding aerial navigation:—

1. *Journal of the Aeronautical Society of Great Britain.*
2. *L'Aerophile.*
3. *L'Aeronaute.*
4. *Bollettino della Societa Aeronautica Italiana.*
5. *Wiener Luftschifter Zeitung.*
6. *Illustrierte Aeronautishe Mitteilungen.*
7. *The Engineer.*
8. *Engineering.*
9. *Le Genie Civil.*

APPENDIX II.

Further Trials of Zeppelin II.

On 9th October, 1906, a further trial, lasting about two hours, was carried out. Rising to a height of about 450 feet, the air-ship manœuvred over Lake Constance very successfully, and finally returned to its shed near Frederichshafen, in safety. The maximum speed (taken accurately by theodolites), was 12 metres per second, or nearly 30 miles per hour. At the commencement of the trial, the wind was N.N.E., its velocity at a height of 2,500 feet being about 2½ metres per second; but at the close of the operations, there was a dead calm. During the greater part of the time, only one motor was in use, but it is not clear from the reports, whether both motors were, or were not, in action, when the highest speed was attained. The rolling weight was again in use at this trial.

Remarks.—This appears to have been a very successful trial; the maximum speed, 30 miles per hour, is the highest ever attained by a "Dirigible."

APPENDIX III.

The Santos Dumont Flying Machine.

No very accurate details regarding this machine are as yet available, but the following general description may be found useful:—

Type.—Similar to that of the Messrs. Wright, with the exceptions that the two halves of the sustainers are fixed at a diehedral angle, and that the box-shaped rudder for steering is placed much further in advance of the sustainers.

General Dimensions.—Length, 32 feet; greatest width, 39 feet; weight with one passenger, 465 lbs.; lift per square foot, ·5 lbs.; lift per I.H.P., 19·4 lbs., at a velocity of about 30 miles per hour.

Sustainers.—Two box type wings, each 18·5 feet by 11 feet; surfaces 7 feet apart; sustaining area, 861 square feet.

Suspension.—The long protruding girder, which carries the car, is fixed at one end to the sustainers; at the other end a box-shaped rudder is fitted.

Car.—A willow basket fixed in the girder above mentioned.

Motor.—24-I.H.P. petrol motor, working at 1,100 revolutions per minute.

THE "SANTOS DUMONT" FLYING MACHINE

Fig. 11

Plan.

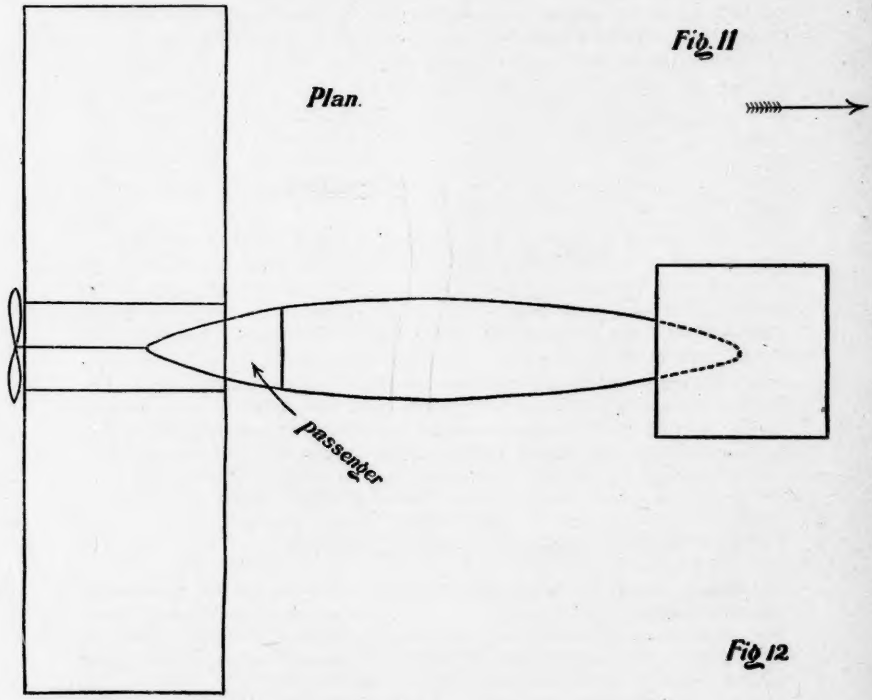
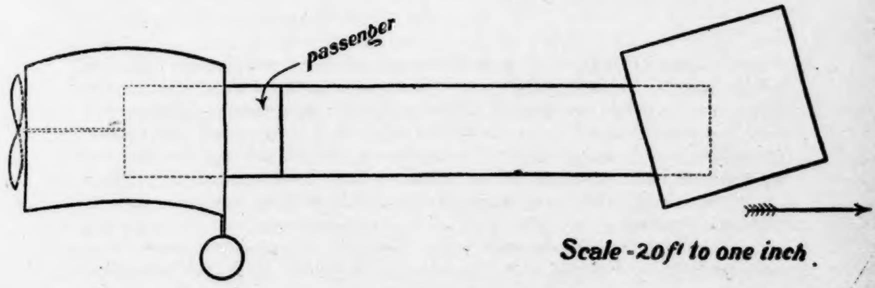


Fig. 12

Side Elevation



Scale - 20 ft to one inch.

Propulsion.—Aluminium two-bladed propeller, 6 feet in diameter, fixed in rear of the sustainers.

Steering in a Vertical Plane.—The rudder can be moved right or left, by means of a steering wheel.

Steering in a Horizontal Plane.—The same rudder can be moved up and down, by means of a steering lever, and the whole machine rises and falls accordingly.

Equilibrium.—No special apparatus.

Trials.—13th September, 1906.—At this trial the machine covered a distance of over 25 metres, but finally came to the ground backwards, breaking the propeller. This accident was due to a mistake on Mons. Santos Dumont's part: he wished to rise, but moved the rudder too sharply; the machine, in consequence, stopped momentarily, and then slided down backwards.

23rd October, 1906.—This trial was much more successful; a distance of about 50 metres being covered, the machine throughout moving at a height of about 10 feet from the ground. As Mons. Santos Dumont's object was merely to fly the distance required by the conditions of the Archdeacon Prize, he then stopped and made the landing quite safely.

Remarks.—On the whole this machine worked fairly well. The lifting power is, however, indifferent, and the steering apparatus is much too powerful for such a small machine. The centre of gravity appears to be unduly close to the centre of pressure.

APPENDIX IV.

Seeing Beneath the Waves.

Since the remarks on watching the movements of submarines from balloons were written, some further information on the subject has come to hand. In a very interesting article, published in *Knowledge*, May, 1905, the late Rev. J. H. Bacon, a well-known and skilful aeronaut, describes a voyage he made across the Irish Channel (in a balloon) for the purpose of taking photographs of the bed of the sea. One of these photographs is given, and shows clearly the rocks, sand, etc., at a point where the water had a depth of 60 feet. There seems to be very little doubt that a submarine would, in most circumstances, be quite visible, and that its movements could from time to time be easily traced.

Sir Hiram Maxim:—You have heard some remarks to-day on Professor Langley's "Whirling Table," as he calls it. That was a very small machine compared with those I have experimented with myself. Some two years ago I took the opportunity of making some experiments at the Crystal Palace, around a circle which was something like 300 feet in diameter, at a speed of eighty miles an hour. I had about 100-H.P. at my disposal. In those experiments I was able to demonstrate that the lifting power of aeroplanes at enormously high speeds is a great deal more than had even been suspected. Suppose, for example, we have an aeroplane 20 inches wide, the front edge of which is 1 inch above the horizontal; that is to say, 1 inch in 20. If you force that through the

air, every time it goes 20 inches it forces the air down 1 inch. It had been supposed by many of the old mathematicians that the lifting effect of an aeroplane of that character would be equal to the wind blowing against a normal plane at a velocity at which that would force the air down. For instance, this would force the air down 4 miles an hour (at the velocity I tried — 80 miles an hour). The mathematicians computed that the lifting effect would be the same as the wind blowing, say, 4 miles an hour upward against *that* plane, which would be an extremely small amount, viz., ·80 of a pound to the square foot. By actual experiment I found that it was at least a hundred times as great; in fact, it was phenomenally great. I think Lord Kelvin was first to point out, when he came down to my place, that Newton's law was altogether wrong in regard to the lifting effect of aeroplanes; and Lord Rayleigh said that planes travelling at a high velocity and at a low angle, lifted much more than anyone had ever supposed. Supposing that you are driving, according to the old way of thinking, an aeroplane through the air like *this*; supposing *this* is 20 inches wide, and *that* the sine of the angle is an inch. It has been said that if you increase the sine of the angle to 2 inches, the aeroplane will lift four times as much, because it will force the air down at twice as great a velocity; and as the lifting effect is in proportion to the square of the velocity, the lifting effect will be four times as great. In other words, it was believed that the lifting effect, everything else being equal, was in proportion to the square of the sine of the angle. Lord Rayleigh took the matter up. He said : "Suppose we have two aeroplanes, the sine of the angle on one of which is an inch, and the sine of the angle on the other precisely like it at the same speed is 2 inches, the aeroplane with 2 inches ought, according to the old philosophers, to lift four times as much as the aeroplane the sine of whose angle is 1 inch." But when he came to try it he found that the aeroplane which was supposed to lift four times as much as the one with the 1 inch sine did not lift quite twice as much. I saw the experiments myself, and they were most ingenious. You will find that the lifting effect of aeroplanes is a great deal more than has been thought hitherto, provided that the angle is very low indeed and that the speed is very high. Professor Langley has given us some names and terms. He suggests that we should call the tendency to go with the wind "the drift," and the lifting effect "the lift." I have succeeded in getting a lift eighteen times as great as the drift. I think Professor Langley has done the same; but when you come to these enormously high speeds, the result is very much better. I think that now there cannot be any question about the success of flying machines. The Wright Brothers, as you have heard here to-day, have remained in the air for half an hour travelling at the rate of forty miles an hour. That is a true flying machine. The flying machine has come, whether we like it or not, and it is a thing that we have to compete with. If other nations get ahead of us we shall be left out in the cold, that is very evident. We find that the Americans have spent a considerable amount of money through Professor Langley; we find that the French Government have spent large sums of money on experiments with balloons, and M. Santos Dumont has any amount of money at his back, and is trying some experiments in France; we find that the German Emperor has taken the matter up. There can be no question about it. Flying machines have already been made; they are coming, and they will soon be in the air in more senses than one. Whether we like it or not, we shall be forced to take up the matter ourselves, or we shall indeed be left out in the cold.

Lieut.-Colonel T. H. Baylis, K.C., M.A., V.D., late 18th Middlesex V.R.C. :—I did not wish to rise at this early stage of the discussion. I came to this meeting, as most of you have come, seeking information, and I intended to ask a question which has been very ably answered by my friend on my right. It has always seemed to me, being a sportsman all my life, that the lifting power of a bird is really wonderful, and how it, by springing from its feet, or by any other cause, is able to rise and use its wings. But we have had given to us, by Sir Hiram Maxim, an answer to that question, for it has been explained to us that the lifting power is much greater than was ever anticipated. This matter, as with other matters of equal importance, attracted the attention of Lord Rayleigh, and Lord Rayleigh, I understand, entirely adopts Sir Hiram Maxim's view. I hope it is no presumption on my part to rise, because I merely do so for the purpose of asking for information. There are some who do not like to get up and ask questions, though they are very glad to have them asked by others. I think I may say that the puzzle of the world hitherto has been for human beings to utilise air by flights in it. We had it as early as Minos, the King of Crete, when it was attempted in those days, as Ovid and Horace tell us, to use the air for the purpose of locomotion. We know the old Greek legend, how Icarus, son of Dædalus, is said to have used waxen wings, which, when flying from the tyranny of Minos, melted in the sun, with the result that he fell into the Ægean Sea, which has since been called the Icarian Sea. I only mention these things to you in order to show what an interesting subject it was in former ages. Minos lived about 1406 B.C., and ever since that time the subject of aërial navigation has puzzled the world. Now, however, great light is being thrown upon it by the present generation. They are beginning to find out the puzzle not only of how to travel by balloon—which has been certain for some time past—but even by what are called flying machines. I was going to suggest this, that I think it would have been desirable if we had had models to illustrate this interesting and instructive lecture; but even there my question has been anticipated, because beautiful illustrations of the machines have been shown on the screen. It certainly is wonderful to think of what the ingenuity of man is coming to. I have no doubt the lecture will be read, not only in England but in America, and other places, and also the observations which have been made by Sir Hiram Maxim. I can only add this one remark, that when I was coming down here the wind was very much against me, and I thought at the time, how can the makers of balloons and flying machines get on with such a wind as this? But the ingenuity of man is so great that I believe all these difficulties may be overcome, and I think a greater interest will be aroused in the subject of aërial navigation by the instructive lecture we have had here to-day.

Colonel J. E. Capper, C.B., R.E. :—I would like to say a word with reference to the point referred to by the lecturer of being able to see what is under the water. It might be of interest to you if I narrated an experience of my own. At Gibraltar I noticed that I was able to see rocks going out into the sea for some little distance. The other day I happened to be passing in a balloon over the Medway, which is not noted for its great clearness, but I and my companion were both very much struck with the clearness with which we could see the whole of the channel. It is an intricate channel, as anyone acquainted with the

Medway knows. It is buoyed for a great portion of its length; but even in that comparatively dirty river, from a height of 1,500 or 2,000 feet, we could see quite clearly the whole of the channel underneath. For the purposes of marine surveying, I cannot help thinking that anything in the nature of a flying machine or a dirigible balloon will be exceedingly useful.

Colonel J. D. Fullerton, in reply, said :—I do not think there is very much for me to say in reply. I was much interested to hear from Colonel Capper that he was able to see the channel in the Medway. I was rather afraid that the water in the Medway was too thick, and that the bottom would not have been very clearly visible there. I think there is not much doubt about it in many places in the more open sea, but in the rivers and estuaries I thought there would have been great difficulty. However, you say, Colonel Capper, that you saw the channel in the Medway?

Colonel Capper :—Very clearly indeed.

Colonel Fullerton :—Do you think you could have seen objects passing along under the water?

Colonel Capper :—No, but I could have directed the channel a ship should have taken with the greatest ease.

Colonel Fullerton :—I did not say anything in my lecture about the lifting power of birds and so on, because I more or less dealt with that subject in my old lecture; but, of course, it is a very interesting question. I think the real secret of the flying power of birds is, that their shapes are specially adapted for flying. The body of a bird is almost the ideal shape for least resistance, as are also the wings, a fact which is not generally understood. Some of the very swift flying birds have a most excellent shape, and I think it is to this shape that their success is due.

The Chairman (Major B. F. S. Baden-Powell) :—The lecture that we have heard this afternoon has been of very great interest to me, especially as, perhaps, it is not out of place to say, I happen to have seen each one of the dirigible balloons that has been described, and, I might almost say most of these flying machines. I had the pleasure of taking a trip on Sir Hiram Maxim's great machine; I have seen Phillips' machine careering round his track, and I have also seen Langley's models and his engines. Although the lecturer has said, in regard to dirigible balloons, that they are not a thoroughly satisfactory method of solving the problem of aërial navigation, still, I do not think that I quite agree with him when he says that he thinks they are hardly worth making. Though it appears to us that flying machines, that is to say machines on the "heavier than air" principle, are very likely to come forward in the next few years, still, we cannot say that we have actually got a practical machine yet, and until we have I think it is highly desirable that we should give every attention to the subject of dirigible balloons. The French have started the subject, as they did with submarines and various other inventions, and the Germans are not far behind them with their great Zeppelin air-ship, which has beaten all

records in going thirty miles an hour. With very little improvement, in fact, as they are to-day, I think they may be considered a new instrument of war which we have to reckon with. Then as regards flying machines, we have all been aroused by the news, during the last week or so, from Paris about the Santos Dumont flying machine. Some years ago Santos Dumont awoke us to the possibilities of the dirigible balloons; and although I do not think myself he made any special progress, or showed us anything that was particularly novel, still, he did wake public attention to the matter. That has resulted in other inventors taking the subject up, and they have made a great success of it. In a similar manner we may reasonably expect that the bringing of the subject forward by him will encourage other inventors, and will encourage the public generally, to take an interest in the matter of flying machines. No reference has been made in this paper to a great many other experiments that are now being made. Bleriot, Vuia, and Dufaux are three names that occur to me of inventors who are now at work on this subject. When I say that they are not referred to in the paper, it is probably due to the fact that the results so far obtained by them are hardly of sufficient importance to entitle them to be included as inventors. I merely mention the names to show that there are a great many people hard at work building big machines, well engined and carefully made, which may any day turn out to be quite as successful as the machines of either the Wrights or Santos Dumont. I have only newspaper reports to judge by, but as regards Santos Dumont's latest flying machine, I am rather inclined to think it is nothing very wonderful, and it certainly has not, as has been said, at all obtained the same results as the Brothers Wright in America. To remain for a few seconds up in the air, and to be propelled along at a speed of thirty miles an hour, is nothing very wonderful. The chief difficulty which comes in, then, is the stability of the machine, and the question whether it will remain in the air. We know from small models that very often the machine will go along very well through the air, but it is exceedingly liable to suddenly tumble over, and it is very difficult to know why it should do so. Other models have been made which are able to keep themselves up well. So that I am very much afraid, from what one reads about Santos Dumont's machine, that it may prove to be a not very stable machine, and liable to tumble over at any minute, because in the three or four different trials he has made he always seems to have come down with a big bump on the ground and smashed his wheels and things, which does not look very satisfactory. However, we do not know. We hope he will continue his experiments, and will obtain better results. There is one point brought forward by Colonel Fullerton on which I may perhaps throw some further light, and that is, as regards the most suitable material for constructing flying machines. He mentioned steel tubing as being perhaps the most suitable. A couple of years ago I made a good many experiments in this direction. I constructed a sort of boat-like apparatus mounted on wheels to run down an inclined plane, and at the bottom of this it was shot off over a sheet of water. I tried fixing on to this boat various systems of aeroplanes, chiefly with the object of testing the various materials, seeing which seemed to be most suitable and what strength was required, because it is rather difficult to calculate how outstretched wings will behave when they are in free air with the weight of a man attached to them. I also wished to test the balancing. I have some photographs here, which I shall be glad to show to anybody who would like to see them, of the apparatus. The framework of the machine

was constructed of bamboo, and I found from a number of trials that I made that that material seemed to be infinitely better than steel tubing, chiefly for this reason, that if I got a piece of steel tubing of an equal weight (of course, when I say of equal weight, it is difficult to compare the two things); but taking a piece of steel tubing of at all equal diameter to the bamboo and of the very lightest gauge, I found it was heavier and not nearly as strong, because when a weight was brought to bear on the steel it had a way of suddenly buckling, and it was then of course quite useless. Whereas the bamboo, when it had a great strain brought to bear on it, would bend, gradually giving more and more, and when the strain became so great that it could stand it no longer, as a rule it simply split, and though it was greatly weakened in that way, it still retained a great deal of elasticity and of strength. So that I found it altogether the most suitable material as regards the experimental stages. I made some wings, extending to about 12 feet on each side of the boat, perfectly flat without any stays or props of any kind. That arrangement looked very weak, as if it must double up when it had the weight of a man supported by it in the air; but, almost to my surprise, it did not do this, and the two bamboo poles—I forget their exact diameter, but of *about* 2-inch diameter—were quite able to sustain the weight of the man and the apparatus in the air. Then, as regards motors, I think perhaps the lecturer has not emphasised sufficiently the extraordinary progress that has been made in recent years in light motors. I was reading a very short time ago a paper by Dr. Pole, written in 1882, on the subject of aërial navigation, in which he stated that the ordinary light engine weighs about 1 cwt. per horse-power; "but," he said, "Mr. Thornycroft has now so much improved on this that he has actually succeeded in bringing the weight down to 43 lbs. per horse-power." A few years after they got down to 10 lbs. per horse-power, and that was thought extraordinary; but these latest engines of Buchet and Antoinette claim to produce a force of a horse-power for a weight of 2¼ lbs. I think that is less than the lecturer stated, but I got these figures from the circulars issued by the firms. I do not know whether they are really accurate, but this, of course, is a perfectly marvellous power for the weight. In conclusion, I only wish to reiterate and emphasise what has been said as regards the great importance of this subject. I do not think that we have realised—when I say *we*, I mean the British public—what a tremendous question this may be in a very few years' time. When we look at the rapid strides that some inventions have made during the last ten years (take, for instance, motor cars, submarines, and a lot of other inventions that could be named), it is really, I think, quite possible, and I believe probable, that within another ten years we shall have machines going through the air in a really practical way. This means a great deal. Directly one good machine has been made and is capable of going through the air at a good speed and maintaining its position there, any Government can at once get hundreds of machines made to exactly the same pattern, and it will be worth their while to do it. This is a very important matter for us English, because it means at once that our great Navy is practically useless as regards being our first line of defence. It means that a more powerful apparatus has come on to the stage of war which, in a duel with a ship, can make sure of getting the best of it. It can get over the ship and drop explosives on it, and the ship cannot reach the flying machine. And, moreover, it might even come in as a method of invasion. Hundreds of flying machines could come over the Channel, and our great Navy would be absolutely powerless

to prevent them doing so. Of course, these are dreams of the future, which anybody may say are rather fanciful; but at the same time, I think it is most important that we should keep our eyes open and be prepared against such eventualities. One of the best plans that occurs to me as a means of protection against these flying machines would be to have guns mounted so that they could fire almost vertically upwards. If a flying machine appeared to-morrow over our heads, our guns could not point up at it, even though within range of their fire. Possibly rockets might be a useful means of protection, especially against anything in the nature of a balloon filled with inflammable gas. Then we must go in for overhead protection. Our ships must have some kind of armour to protect their decks, and all our magazines and military stores must have some kind of bomb-proof roof. Of course, I am leaving out of the question the supposition that we had our own aërial ships to fight them. But all these are subjects which I think we ought to be carefully considering while we have time. We must not neglect these warnings of danger, because even if they are fanciful, there can be no harm in being prepared against such a possibility. Colonel Fullerton has already referred to the race which is being projected from Paris to London, and I think that will be a means, if we do not have developments before that, of instructing the British public in the possibilities of aërial navigation. If we see some French machines coming over to London, and perhaps going back again, at racing speed, we shall realise what would happen if we were at war with such a country. I think it is of great importance to England that we should be able to rule the winds as we now rule the waves. There is only one more duty for me to perform, and that is to express on your behalf our thanks to Colonel Fullerton for the exceedingly interesting lecture he has given us this afternoon.

SOME NOTES ON ORGANISATION, WITH SPECIAL REFERENCE TO PREPARATION FOR WAR.

Communicated.

I.

INTRODUCTION.

THE great importance of organisation in all the business of life is generally accepted, and most of us assume that we understand the reasons for this, and that we know generally what is meant by the word, and what are the broad principles to be followed in applying it to any particular branch of human affairs. But as regards military organisation, are we right in assuming this? Have we got very clear ideas on the subject, and is it not also the case that, in their zeal to acquire a knowledge of the best way to employ troops, officers are sometimes apt to overlook the importance of organisation? It is the object of this paper to stimulate thought on this subject by suggesting some points for consideration, and by trying to see how far general principles have been followed or neglected in our own as compared with some other military institutions.

Meaning of the Word "Organisation."

We must in the first place clear our minds as to the meaning of the word "organisation," so that we may agree with regard to the sense in which it is to be used, and so avoid the confusion which must result from the use of an ambiguous term. That this is necessary may be concluded from the fact that the word is used in a variety of senses which, when we come to examine them closely, will be found to differ from each other considerably.

(*a*). The most important, and probably the most correct meaning given to it is in an abstract sense, as if it were a science conformity with whose principles is necessary if a certain desired result is to be attained. As the word itself shows, this science would deal with the principles under which a body or agency is furnished with organs having special functions, mutually dependent, and all essential to the healthy life of the body. Example: "Good organisation is essential to the success of any business community."

(*b*). A secondary meaning, in a somewhat more definite sense, is implied when the word is used with reference to the application of the science to a particular agency or body. In this form it represents an art rather than a science. Examples: "The General Staff will be as much responsible for the war organisation of the Auxiliary Forces as of the Regular Army itself." (S. of S. Mem. on the General Staff, September, 1906.)

"The organisation of a division should include a due proportion of engineers."

(*c*). Very frequently the word is made use of in a more concrete sense to denote the body itself; in substitution, in fact, of the word "organism." The latter would, perhaps, be the more correct term in this case, but it is seldom employed, and we must be content to hear the word organisation take its place. Example: "The Soldiers' and Sailors' Families Association is an organisation for the assistance of individuals under certain conditions."

(*d*). The three interpretations of the word given above differ from each other in degree of limitation or restriction of its use. They all include, however, the idea of a body which has life, energy, functions, the power to act and, if necessary, develop. There is, however, a use of the word "organisation" in which this idea is not preserved as fundamental, and it is thereby stamped as etymologically corrupt and illegitimate compared with the three others. This occurs when "organisation" is used in a sense implying any preparation for an event or a given set of circumstances or sometimes classification, but only as a preliminary to making the best use of a given mass of material, if subsequently organised. It is synonymous with and connotes arrangements, plans, schemes, worked out, no doubt, with great forethought and labour, but having for their object the attainment of a certain desired purpose by means of an agency or agencies, and not the formation or improvement of the agency itself. Examples: "The organisation of the review was well thought out," which clearly means "the arrangements for the review," though the troops taking part in it were, of course, organised bodies.

"The organisation of labour" or "of charity," meaning the classification or distribution of the available resources to the greatest advantage, though the societies or leagues to deal with the available power will have to be organised.

It is possible that the above analysis of the various meanings may be somewhat strained. It will serve, however, to explain and give prominence to the conceptions of organisation as a science and as an art, *i.e.*, the first and second meanings in the above list and those in which it is used in the remainder of this paper. The word organism will be used for the third meaning, while for the fourth some entirely different word will be employed.

II.

Principles.

Organisation in sociology has been traced from the earliest records and still earlier traditions of the human race. It has been compared, in some of its chief characteristics, with organisation in a living animal body, and it has been shown that in both the state of the organism at any given period is due to a process of gradual evolution. In the case of the latter, evolution will doubtless follow its natural

course; but as regards the former, authorities differ as to the possibility of changing the organisation of a social body in conformity with predetermined principles. It can scarcely be denied, however, that all changes in military organisation are due to an attempt to forecast the future, to improve on the past, and, with the help of the most recent experience, to adopt such changes as are likely to produce better results in the future than in the past. It is assumed, therefore, that re-organisation in military matters can and should follow definite principles, and that every effort should be made to ascertain these principles, instead of leaving matters to unaided evolution.

It would be out of place here to enter on an elaborate examination of the principles of organisation. The subject is too vast and would lead us too far from our immediate object. At the same time, it will be a convenience to enumerate some principles, because they will afford several different standpoints from which to consider military organisation. It is not proposed to discuss the question of whether they are or are not principles, but only to put them forward as so many pegs on which to hang a few remarks, which are thereby arranged in a manner which facilitates investigation and tends to concentration of thought. The principles selected for this purpose may be called:—

1. Definition of object or purpose.
2. Sufficiency of material.
3. Proportion of parts.
4. Relation of parts.
5. Necessity for central control.

As already pointed out, the word "organisation" implies the furnishing of a body with organs which must bear to each other a certain relation, and must individually and collectively be essential, or not inconsistent with the healthy life of the whole body. The purpose for which the body is to exist and the conditions in which it is to live become, therefore, matters of primary importance.

The First Principle: Definition of Object or Purpose.

This brings us to the first principle, namely, that a clear idea must be formed of the object, to attain which the organism exists or is to be created. It frequently happens that there is more than one object or purpose involved. In some cases they do not conflict with each other, and it is sufficient for our purpose to regard the more important as including the less. In other cases the objects to be attained are so different that the organisation suitable to the one is found not to be the best for the other, and a compromise becomes necessary.

In military organisation, however, the general principle seems to be forgotten, or at any rate it is ignored in practice. On the one hand, we find France, Germany, Switzerland, and Japan keeping constantly in mind the principal object for which their military forces are required, and organising them accordingly. On the other hand, we have until recently attached too little importance to this principle, even as regards our Regular Army, and we have almost entirely neglected it with reference to our Auxiliary Forces.

The purpose for which the Regular Army existed was in former times a matter lying in the sphere of what has recently been described as latent possession. There was a vague general idea, but no attempt was made to reduce it to expressed terms until Mr. Stanhope, in December, 1888, issued a memorandum enumerating the duties of the

Regular Army. The purpose of the Regular Army then entered the sphere of conscious possession, and year by year became more definite, and therefore, for the purposes of organisation, more useful. Even now, however, although the plans for the larger campaigns are more or less worked out, we are still without a definite pronouncement of general policy to guide our normal organisation. It is no doubt true that the conditions of our Empire preclude the possibility of our stating the purpose for which the Army exists or the conditions under which it will take the field, in such precise terms as is possible for Germany, France, Switzerland, or Japan. We may have to fight in any part of the globe, in any climate, in civilised, closely populated countries, across waterless deserts, or through wild, mountainous districts. No particular organisation of the Army can be expected to suit all these varied conditions, and it is urged by some that we should in consequence leave matters in a vague and indeterminate, or as they are pleased to call it, an elastic state. But unfortunately for this contention, success in war depends on complete preparation in peace time, and this preparation includes the accumulation of equipment in precise quantities for units whose exact war strength in men and horses must be known to all concerned.

This elaboration of detail certainly tends to rigidity rather than elasticity, and it is also objected to as unnecessary, because our naval supremacy, we are told, will secure for us time to complete our preparations after the outbreak of war. This, however, is suspiciously like an excuse for procrastination, and moreover we can imagine at least one great war in which every hour of delay would imperil the success of ourselves and our allies. Accepting the necessity for peace preparation, and recognising that mobilisation details cannot be completed in the absence of precise information as to the composition in war of the various units of the Army (*i.e.*, war establishments), the military authorities have always worked upon what is known as a normal organisation for service in a civilised country with a temperate climate. We are thus able to compare our tactics, organisation, and training with those adopted by the great military Powers who prepare their Armies under similar conditions; and incidentally we are best prepared for the contingency in which time would be the governing factor, though it is not to be understood that this contingency is therefore considered to be the most probable. All other cases, some of which may indeed be far more likely to occur, are treated as exceptional, because time would probably be of less importance, and we should be able to carry out the modifications of our normal organisation required by the circumstances of the campaign.

In the case of the Auxiliary Forces, the neglect of the principle we are considering has been even more marked. In the past we can trace no "purpose" in our methods of dealing with them, except, perhaps, what may be understood by the words "Home Defence." This term amounts to little more than an expression of the native instinct of fear or self-preservation, common to all animal life, and is much too vague and elementary to be accepted as the "purpose" for which our Auxiliary Forces exist. No organisation could be logically attempted on so indeterminate a basis as this. We required more precise terms in the proposition, and in attempting to get them we found ourselves plunged into difficulties and unable to make any progress in the argument because of the conflicting proposition of the "Blue Water School," that the Navy is our main line of defence.

In the meantime, organisation for war as regards the Auxiliary Forces was almost impossible.

It is certainly true that the military authorities have done their best in the last ten years to evolve plans of operation for home defence under the various hypotheses submitted to them by the Government of the day. But these plans have in every case been framed to suit the existing strength and condition of the Auxiliary Forces. They have been dependent on the composition of the forces, instead of (as should have been the case) the forces being organised to suit the requirements of home defence.

Vague as has been the purpose of home defence, the idea that Auxiliary Forces should be reckoned as an asset for over-sea requirements has been still more shadowy. It has been dimly recognised as a possibility, but has scarcely ever found expression in any State document.

If, however, for "Home Defence" we substitute "Imperial Defence," we at once have a basis of purpose common to all the services of the Crown, and from which the purpose of each can be determined with due regard to the part to be played by the others, whether for home defence or for service abroad. The hope of the future lies, in fact, in the recognition of the necessity for observing in every case the principle of purpose.

III.

The Second Principle: Sufficiency of Material.

Even when the object to be attained is clearly determined, we cannot at once go ahead with designing the requisite organisms, or improving those that exist. It would no doubt be possible to conceive an ideal which would most nearly effect our purpose, but we must remember that we are not dealing with one of the higher or natural sciences, founded on laws which are not of man's making, but that what we are now considering is of human origin and for human affairs.

We cannot, therefore, work to an ideal which might be theoretically perfect, for we are bound to take account of facts as we find them in the ordinary life of the world as evolved and shaped by man. In other words, we must deal with practical facts as well as theoretical ideals, and modify the latter to conform with the former.

In practice, then, we find that the material available for forming an organism is invariably limited, and that unless we recognise the degree of this limitation we may fail to realise our organism for want of material.

In military organisation this principle is usually observed, though sometimes it is forgotten or conveniently ignored.

In Armies raised on a system of universal service the available material consists of the manhood of the nation within certain ages and with certain exceptions. The size of the total military force can be determined with the certainty of not exceeding the available supply of men. The organism can be designed so as to suit the characteristics and capabilities of the various categories in which the men may be arranged according to their age, education, civil employment, etc. The margin between the strength of the military force and the available manhood may vary; in France, for example, it is smaller than in Germany, but the principle of designing the organism to suit the extent and quality of the available means is always observed.

In England the amount of manhood material could be assessed with equal certainty, but under our voluntary system it is not at all available. The amount which is available cannot be pre-determined—it can only be estimated by a system of averages. The Adjutant-General bases his calculations as to the number of recruits he is likely to obtain for the Regular Army, and as to the size of the reserve forces, on the figures for previous years, actuarial calculations, the state of the labour market, and so forth, and the process is carried out with so much care that for practical purposes we may say that, as regards the Regular Army, the principle we are discussing is observed. If our requirements for war cannot be met, the conditions of enlistment, pay, and service might be varied by the Government, until the requisite numbers are obtained, subject to the manhood limitation.

In the case of the Auxiliary Forces, we know that every man can be called out to meet the extreme emergency of invasion of Great Britain. This contingency has, however, been authoritatively removed from our terms of reference, and the lien on the Auxiliary Forces, which in this connection we possess, becomes of little value. On the other hand, although we know their exact strength and the number who have attained a certain standard of efficiency, we cannot even estimate the number of those on whom we can rely for service oversea in defence of Imperial interests. We have plenty of general assurances that they will not fail us *when the time comes*; but we are also told that not a single officer or man will register his name beforehand. We cannot tell, for the purposes of war organisation, what the number will be, even approximately, whom we are to organise into military formations, for whom we are to provide higher commanders, staffs, transport, equipment, etc. They may "come forward in their thousands," but we certainly know that the whole number will not be available for our purposes. The available number may be anything from 1,000 to 300,000. On these terms, organisation is impossible, because the principle we are considering is wholly disregarded. We may prepare a scheme showing how we should employ a given number of officers and men (*if we get them*), but if when the times comes we get a greater or a lesser number, we shall have at the eleventh hour to re-cast our scheme—organisation will have proved to be a dead letter and our scheme but waste paper. We shall then have to begin organisation in the proper meaning of the word, and with all that is required by it, as enumerated above. Those who speak of "abandoning the idea of binding engagements so dear to the military doctrinaire" only show that they have never seriously studied organisation and preparation for war, that they have not enough imaginative power to foresee the state of affairs when a national crisis shall have arrived, and that they are therefore not reliable authorities as to the steps to be taken to prepare for such an emergency.

IV.

The Third Principle: Proportion of Parts.

Having determined the purpose to be attained and the amount of material available, it becomes possible to devote attention to the construction of the organism itself. It will generally be found that each organism, designed to fulfil its own special purpose, is but a

part of a higher organism destined to effect a larger and more important purpose, and that the higher organism includes a number of types of lesser organisms, the number of each type varying according to its special functions. For any one design we must, therefore, decide what types and what number of each type of lesser organisms are necessary, that the higher may fulfil its duties in the most efficient and economical manner.[1] The relative proportion between the numbers of each type stands out, therefore, as a matter of such importance that to pay full regard to it may be considered as a principle of good organisation.

In military organisation, however, although no one disputes its importance, it is not always given effect to in application, and it is frequently overlooked in works dealing with the science and art of war.

Even when recognised, it is only in a vague sort of rule-of-thumb manner, such as with reference to the number of guns or sabres to bayonets, for which, moreover, no more intelligent basis is adopted than by striking an average between the proportions maintained by the more important military Powers. The assumption that the majority must be right may be, and possibly is, correct, but as a foundation for organisation, it suggests a decadence of the power of thinking things out for ourselves, just as much as does the habit of copying the details of dress, equipment, and interior organisation of the most fashionable military nation, usually the most recently successful in war.

Proportion of parts must be studied, not only with regard to the strength of the various combatant arms, but in the composition of the units of those arms as well as of every unit, whether combatant or administrative, which is required for service in the field from the base to the outposts of the Army. Foreign Armies are constantly being altered in this sense, and being brought up to date according to the views held by the military authorities in each country. The process is not spasmodic but normal, whether in large questions, such as an increase in the number of batteries in an Army Corps, or in minor details, such as the addition of a wireless telegraph detachment to a telegraph battalion.

Can we conscientiously claim that the additions or reductions in the various parts of our Regular Army, announced in past annual estimates, have been inspired by a similar desire to improve the fighting efficiency of the over-sea force as a whole? Or must we reluctantly admit that there is some truth in the contemptuous charge of tinkering?

In our Auxiliary forces the sense of proportion has been conspicuously absent. They have been allowed to grow without any attempt at control in this respect, and the wish of the individual seems to have been the main factor in the development of the forces. The result is that we have (for example) some 20,000 Garrison Artillerymen, for whom in the past nobody could suggest a *raison d'être*, while some of the administrative services, so essential in war, are almost entirely absent.

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[1] It may be noted here that it has been taken for granted as axiomatic that efficiency and economy are desirable, and this has, therefore, not been stated as a principle of organisation.

It is perhaps right, and certainly natural, that strategy and tactics should attract most of the attention of military students, and that their thoughts should mainly be concerned with the combatant arms, but unless they bear in mind the principle of proportion of parts, there is some danger lest the result of their study may be a little one-sided, and its application in war time more difficult than was supposed. The meagreness of peace establishments is a contributory cause of this neglect. For instance, at manœuvres we see batteries of 4 guns, and perhaps 1 or 2 wagons, and it is pardonably difficult to remember that they represent 21 vehicles (including 6 guns), 194 men, and 170 horses. We seldom see ammunition columns, and supply columns never, and if these units are remembered in orders, it is almost with an effort, and they are briefly dismissed with an order of the "to conform" type. It is the same with other imaginary units. It is, of course, impossible, for financial and other reasons, to conduct peace manœuvres with all the troops mobilised as for war, but the value of an object lesson in organisation, and the false impression produced by constantly seeing half-formed units, suggest the advisability of completing a small portion of the manœuvre troops to their full war establishment, as was done last year in the French manœuvres.

The fact is that no organism is complete unless each of its component parts or lesser organisms is also complete, and that the mind must accustom itself to comprehend the whole body and not some parts only, even though those parts may be apparently, from one point of view, the most important.

In the foregoing paragraphs the expression "whole body" implies a body that is complete in itself and capable of independent action. Under the Army Corps system, a division was not self-contained. It only formed a part of the Army Corps, which with its complement of Corps Troops represented the smallest independent military organism, the division being but a limb of the body. Recent military policy has been directed towards abolishing the Army Corps and making the division an independent fighting body, self-contained and self-supporting (for a time) in itself. Its infantry brigades, divisional artillery, divisional columns, and divisional medical units, are the limbs or lesser organisms, incapable of independent action. The abolition of brigade supply columns and medical units in 1905 was the first step in this direction. If ever a smaller independent unit should be considered desirable, it would similarly have to be furnished with such organs as are essential to its independent existence, but the functions of the divisional commander would, at the same time, undergo considerable change. He would become the director of a group of small mixed bodies, and would lose some of the power of controlling the course of an action, which, as the direct commander of a single force, he could exercise to the fullest extent. There is, however, no sign that there will be any demand for a smaller independent unit than a division, in the normal organisation for European war.

In the British Field Army, according to the present organisation, there are no fewer than 68 types of units, and in a force of six divisions, two mounted infantry brigades, one cavalry division, and one line of communication, the aggregate number of units amounts to 472, 75 being the largest number of any one type (*i.e.*, the battalion). Each

of these types is a separate organism, and its War Establishment is framed so that it may fulfil its duties to the best advantage of the whole force. War Establishments, therefore, show the complete war organisation of the Expeditionary Force, and should be studied accordingly, and kept up-to-date.

Among the types will be found those of the various "Head Quarters." This expression includes the commander and the officers, men, vehicles, and horses required to assist him to perform his duties. The word "Staff" has been discontinued for this purpose, as it was inappropriate to express the whole of such a unit, and the want of precision in its meaning led to inconvenience in the South African War. It is now restricted to certain officers of the General and Personal Staff, and Adjutant-General's and Quartermaster-General's Departments, as shown in War Establishments. The remainder of the *personnel* are shown separately, and are not "Staff."

V.

The Fourth Principle: Relation of Parts.

The next stage in the study of organisation is to consider the structure of each type of lesser organism, or, in military phraseology, to draw up its war establishment. In doing this it is not sufficient to concentrate our attention on the particular duties allotted to the organism in question. If this alone were done, a tendency might be displayed to attach undue importance to some parts to the detriment of the capability of the whole.

At the commencement of the paper we assumed that the parts must be mutually dependent, and must bear to each other a certain relation. This leads us to the conclusion that a proper relation between the several parts is as important a subject for consideration as the number of the parts, and that each and all must be considered with reference to the common purpose of the whole body.

Success in war is the common purpose of the different portions of the whole military organism. Each part must be organised not only to perform its own functions, but to assist the others in their duties and to contribute through them as well as by itself to the common object, in furtherance of which each part must be ready if necessary to think of others more than of itself, and even on occasion to forego the full completion of its functions, which on ordinary occasions it would be its duty to carry out to the letter. We call this co-operation, and enjoin it emphatically as regards the combatant services; but it is a principle which should extend throughout the whole force, and which has to be borne in mind in the general and detailed organisation of each arm and unit. Unselfishness and loyalty to the common good are as necessary in matters of organisation as on the field of battle. It is unnecessary to enumerate examples of disproportionate advocacy of the claims of one branch, service, or even parts of one unit, in disregard to the principle of the relation of parts. Instances will present themselves to the minds of most of us.

In the detailed organisation of a unit the same principles apply as in the larger organisms. The types and numbers of its component parts and their relation to each other require careful consideration. It must be remembered that the relation of parts and their dependence on each other is of greater importance in some cases than in others. A

battery of artillery and a company of infantry are each composed of a certain number of men organised in smaller fractions, but the battery is a single machine in the hands of its commander, and its efficiency as such depends on the combined action of all its parts, whereas the company is an aggregate of fire machines, each of which is practically independent. The relation of parts is, in fact, of greater importance in the former than in the latter. The truth of this is brought home to us when we remember that the loss of a certain number of even the best men of a company would reduce its power by that amount only, but if a battery lost its layers its fire effect would be largely, if not entirely, crippled. Loss of men in the artillery may mean the destruction of the power of the whole unit; in the infantry it means the loss of so many rifles, but the efficiency of the remainder is not thereby necessarily impaired.

The principle of relation of parts is well illustrated in the present organisation of the expeditionary force, to which a separate section of this paper is devoted.

VI.

The Fifth Principle: Necessity for Central Control.

However carefully a particular agency or body may have been organised, it is incomplete and ineffective without a directing and controlling power. The extent to which this power of control should be centralised is a matter of organisation. It is true that some men possess such remarkable powers that they are able to exercise personally to a far greater degree than most men the function of control over the whole organism. They revel in centralising in themselves direct authority over a large number of subordinates, and in the hands of such exceptional men the result is often attended with brilliant success. They are pointed to as successful organisers, and they are fully entitled to the credit of the expression if they themselves control the organism which they have designed or created. If, however, they design an organism for another to control, and if they introduce the methods of centralised authority which might be suitable for themselves, it is open to question whether they could be called successful organisers, because the organism might fail completely in the hands of less capable men who constitute the majority. These few men are perhaps successful commanders rather than successful organisers, unless the organism be for their own use. In military organisation, however, although the will of the supreme commander must be communicated to every part of the body, it is generally accepted that command cannot efficiently be exercised over more than some half-dozen of subordinates, and in dealing with masses of individual agents, command must therefore be delegated. This is so thoroughly understood that it need not be discussed at length; but it may be pointed out that this delegation of power from link to link in the chain of command resolves itself into the organisation of command, and is subject to the same principles as in the case of all other organisms. We recognise the principles of purpose, of proportion, and of relation of parts, while the principle of available material is painfully brought home to us in the matter of paucity of officers. An important feature in the organisation of command is that subordinate commanders are not only responsible that effect is given to superior orders, but are invested

with power of independent action if circumstances demand it. This power naturally diminishes as the chain lengthens, but there is a marked decrease of this power after we pass the point in the chain representing the commander of the lowest independent organism, now the division but formerly the army corps. In the recent adoption of a divisional organisation, the divisional commander, besides having his command increased, has been promoted in the chain of command from the lesser to the higher grade of power. This is an important point in the new organisation.

To enable the function of command to be exercised efficiently and rapidly, commanders of all grades, except the very lowest, are provided with assistants to supply them with information, to receive and transmit their orders, and in some cases to help them to arrive at the independent decisions as to matters not literally communicated to them from superior authority. The means thus supplied is represented in a military organism by what is commonly called "staff"—using the word in its broadest interpretation—and of which the chief of the staff and a colour-sergeant are, in this sense, types at either end of the long chain of command. According to our ideas, the essential difference between "command" and "staff" seems to lie in the fact that responsibility attaches to the former but not to the latter. Will power or command is transmitted down the chain in direct descent from the highest to the lowest commanders, while the functions of the staff are to facilitate this transmission of power. The staff system must be coincident with the command chain, and forms a part of the organism of command rather than existing as a separate organism itself. We have recently adopted a procedure for peace purposes, in which a part of the staff system is not coincident with the upper portion of the chain of command, though it is true that it emanates initially from the same source. Through that portion of its length in which it is not coincident with the principal command chain it has certain functions of command, and to this extent it constitutes an independent command organism. If this system obtained in war we should have two command organisms purporting, it is true, to deal with distinct subjects, but serving one common purpose. It has indeed been proposed that the service of intelligence should also in a great measure be separated from the direct line of command, and it might conceivably annex a portion of the command function. It is a matter for serious consideration whether a system of this sort might not result in the establishment of an *imperium in imperio*, fraught with danger to the common interests.

What has been said above has no reference to the organisation of the Headquarters of the Army in peace, *i.e.*, at the War Office. It refers only to the organisation of an Army for war and in war. The War Office is on an entirely different footing; it has special functions and duties both in peace and war, and there is no intention in this paper to discuss such matters.

VII.

Reference has been made to the organisation of the expeditionary force which has recently been adopted. An attempt to examine it in detail would require so much time that it should be dealt with in a separate paper. It affords us, however, a good illustration of some

of the principles we have been discussing, and a brief reference to it may not be out of place.

The leading features of the organisation are:—

1. The increase of harmony in the relationship of the component parts of the expeditionary force.
2. The strategical freedom attained by the independent cavalry.
3. The establishment of the division as the only independent fighting unit.
4. The modifications, principally in artillery and engineer units, necessitated by recent experience and improved material.

As has been already explained, our organisation pre-supposes normal conditions, *i.e.*, the conditions under which the great military Powers of Western Europe might conduct a campaign, and it is from this point of view alone that the organisation should be considered in the first instance. It follows, therefore, that we must suppose that the whole force is put into the field, and the purpose of the expeditionary force will, under those conditions, be to hold its own, possibly with the assistance of an ally, against the military forces of a European Power.

For this purpose the cavalry must be prepared to defeat the enemy's cavalry whenever and wherever they are met, so that the enemy may be deprived of the power of gaining information and interfering with the movements of the main body or of preventing our cavalry from doing the same with regard to the enemy. Hitherto our cavalry brigades have had the double duty of strategical exploration and protection of the main body; but it has been felt this unduly limits the strategical employment of the cavalry, and that it was necessary to introduce an intermediate force to free the cavalry for their more important duties by providing for the efficient security of the divisions. At the same time, this freedom called for greater mobility on the part of the cavalry brigades, now combined into a cavalry division. A separation of the mounted infantry from the cavalry brigades and their formation, with two spare cavalry regiments, into security brigades meets both these requirements. The demand for cavalry mobility is greatest on the occasion of their engaging the main body of the hostile cavalry, and the organisation is that which is considered most suitable for this supreme moment. It will be seen that the brigades are composed solely of cavalry regiments, and that the R.H.A. are shown as divisional troops. Apart, however, from the question of whether the ammunition column might or might not hamper the cavalry brigadier in his movements at such a moment, it seems that the horse artillery can at this time give more effective support to the cavalry division if they are united under the orders of the divisional commander than if they were distributed to the brigades under circumstances which might occasion the masking of the fire of some of the batteries. There is, however, nothing to prevent the divisional commander from detaching single batteries, with a proportion of the ammunition column, to individual cavalry brigades during the earlier stage of reconnaissance, and the horse artillery organisation has been arranged so as to make this possible. This may be quoted as an example of the importance of the principle of

the relation of parts, previously referred to. It is only by taking a broad view of the purpose of the whole organism that we can differentiate between the claims of the subordinate parts.

Partial reference has already been made to the independence of the division, but the full significance of this feature of the new organisation may not at once be appreciated. The Army Corps commander has disappeared, and the divisional commander has taken his place as the tactical commander, with direct power to influence the immediate progress of the fight. The divisions, being independent, and some 50 per cent. larger than before, must be regarded as small Army Corps, acting at a greater distance from each other than formerly, and covering a larger front. They are strategical units in the hands of the Army commander, who will usually be at a considerable distance from some of his divisions, and connected with them by wireless and cable telegraphy. He disposes of the mounted infantry brigades as security troops in advance of the divisions, but as regards the divisions themselves, he has none of the tactical functions of the former Army Corps commander, and for this reason no combatant force, other than the mounted infantry brigades, is included in the Army troops. The battalion of infantry and two squadrons of yeomanry are only for escort duties. With the full expeditionary force in the field, he would have the cavalry division, six divisions, two mounted infantry brigades, and the remainder of Army Troops under his command. It is possible that under certain strategical conditions, the Army commander might wish to reduce the number of commands which he himself directs, by grouping two or more of the divisions under one hand. For this purpose an intermediate subordinate headquarters is provided to control these divisions, leaving the other divisions directly under the Army commander; but this headquarters would not be mobilised unless the whole Expeditionary Force were to be put in the field.

The new organisation includes all the changes which have been approved in consequence of recent war experience, and improved equipment. These changes affect all arms, and they can best be understood by a close study of War Establishments, every detail of which has been reviewed with the greatest care. The most important of these changes are, however, to be found in the artillery and engineer arms.

Judging from recent war experience in Manchuria and South Africa, the infantry attach greater importance than ever to the support of artillery fire, both in attack and defence. Not only is there justification for an increase of the number of guns, but it is also recognised that a combination of different classes of artillery fire will produce results eminently favourable to the action of the infantry. The shrapnel of flat-trajectoried field guns, the searching power of field howitzers, combined with the possible closer approach of the infantry under their steep descending fire, and the powerful shell of the heavy artillery, afford the means of producing greater effect, in the hands of a skilful commander, if employed in conjunction with each other, than if they are treated separately. The allotment to the divisions of every nature of ordnance, except that of horse artillery, gives to the divisional commander the opportunity of using this enhanced effect to the fullest extent which the tactical conditions admit of, and to the greatest advantage, as a whole, of the division for whose action he alone is responsible.

But such combination, when it is desired, can only be effected if the requisite means have been provided. These means consist of orderly officers, range takers, signallers, orderlies, etc., to enable the senior artillery officer and subordinate commanders to use the whole of the combined artillery in furtherance of the wishes of the divisional commander. The additional *personnel* required for this purpose is shown in the war establishments of headquarter and regimental units of the artillery. The organisation of the supply of ammunition, from the advanced depôt to the fighting batteries and battalions, is based on similar principles, *i.e.*, those of purpose, proportion, and relation of parts, which are, perhaps, better illustrated in the artillery than in any other arm of the service.

The engineers are, perhaps, affected most by the new organisation. The Manchurian War seemed to point to the necessity for considerable increase in the field companies for work in the fighting line. Allowance must, however, be made for the topographical and strategical conditions which precluded lateral mobility to a great extent, and gave to the principal battles the characteristics of siege rather than field work, due to the frequent necessity for direct frontal attack. It is not, therefore, in this direction that we find most change. On the other hand, this war fully confirmed what had been long known, that a development of the communication service is absolutely essential. Army headquarters now have two cable, two wireless, and two air-line telegraph companies, each division has its own telegraph company, while two are allotted permanently for line of communication work. The field companies will, however, be expected to do more work than hitherto, especially in connection with the construction of all the bridges that may be required for the Army. The actual equipment, except a small quantity for minor crossings, is kept well in rear in two trains, so as not to hamper the marching columns when not immediately required. This is in conformity with a general policy, which has been applied to the whole Army. The inordinate amount of transport which formerly accompanied the troops, tended to interfere with their mobility so seriously that their value as fighting bodies was considerably impaired. Transport has accordingly been reduced, so that the front line troops now only carry with them what is essential for fighting efficiency and health, and to render them independent in these respects for a short period of about a fortnight. All else is put further back in the line of march, its distance in number of days of march from the front depending on the frequency and probability of its being required.

Space will not admit of further examination of the details of the new organisation. They can best be mastered by close study of the war establishments of all the units or lesser organisms, destined to fulfil their special functions in the larger organisms of which the Expeditionary Force is composed. Such a study should, however, be comprehensive as well as detailed if the student desires to appreciate the value of the whole force, or to test the validity of the principles of organisation.

THE VON LÖBELL ANNUAL REPORTS ON THE CHANGES AND PROGRESS IN MILITARY MATTERS IN 1905.

Précis from the German by LIEUT.-COLONEL E. GUNTER, *p.s.c.*, *(late) East Lancashire Regiment.*

Continued from the December JOURNAL, p. 1497, and concluded.

PART III.

CONTEMPORARY MILITARY HISTORY.

THE RUSSO-JAPANESE WAR.

FROM THE FALL OF PORT ARTHUR TO THE END OF THE WAR.†

The account of this war was epitomised in the JOURNAL in February (p. 225) and March (p. 342) of 1906, which brought the narrative down to the fall of Port Arthur on 2nd January, 1905, and it is continued here to complete the *précis* of the operations.

In January, 1905, the opposing forces on the Shaho were, roughly speaking, thus distributed, beginning with the Russian extreme right, General Kuropatkin being in supreme command: A mixed detachment was under Kossogowski at Syfantai, Grekov's Cossacks of the Don guarded the right flank, and General Mischtschenko was in reserve with the Ural-Transbaikal Cossacks and the Caucasian Cavalry Brigade. The 2nd Manchurian Army, under General Grippenberg, occupied the first line of entrenchments from Tatshuhanko to Daliantun. In the second line were the Xth Army Corps, east of Suyatun,†† and the VIIIth Army Corps in and about the bridgehead south of Mukden; the mixed Rifle Corps (3 brigades) in and about the Mukden Railway Station. The 3rd Manchurian Army, under General Kaulbars, took up, with the XVIIth Army Corps and the VIth Siberian Army Corps, the defensive line from Daliantun, through Shahopu to Nangansa.

The 1st Manchurian Army, under General Linievitch, continued the line eastward with the Ist Army Corps and the IInd, IIIrd, and IVth Siberian Army Corps, extending along the front of the Shaho as far the hills about the Kautulin Pass. The Ist Siberian Army

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†The maps published with the *Militär-Wochenblatt* account should be referred to.—E.G.

††About 35 kilometres down, and 12 west of the Hunho, from Mukden. —E.G.

Corps was in reserve at Bosinsai. Half a rifle Division of the IIIrd Siberian Army Corps kept up communication at Matsuindan with Rennenkampf's corps, which guarded the left flank with the 17th Infantry Division and mixed detachments at Dalin and Sintsintin, reaching back towards the mountains. Kuropatkin's headquarters were at Tschansamutun.†

The Russian forces numbered 346 battalions, 169 squadrons, 147 batteries. The losses had been replaced, so that reckoning daily casualties at 10 per cent., they had 300,000 men and 1,100 field guns available for battle. The XVIth Army Corps was on the way with 28,000 rifles and 96 guns, and was expected about the 20th January.

The **Japanese Army** stood with the 2nd Army (General Oku, 3 divisions and a reserve) on their left, extending to Lamutun, just east of the main railway line to Mukden.

East of this the 4th Army (General Count Nodzu), with the 10th Division and a reserve division, extended by Tshuanlintsa to Sinluntin. The 1st Army (General Kuroki) took up the line with the Guard Division and its reserve brigade, the 12th Division, and certain reserve troops from west of Yansintun and its pass through Bianupusa, thence bending south to Luishudia.

The reserves were at Shiliho and Yantai. The 3rd Army (Nogi) was refitting at Port Arthur.

The Russians estimated it as 80,000 strong after reinforcing. The remaining forces they reckoned as counting 178 battalions, 61 squadrons, 111 batteries; altogether, 225,000 men and 666 guns.

Early in January, 1905, General Kuropatkin had determined on taking the offensive before the Japanese 3rd Army could arrive, and on making a great cavalry raid against the Japanese communications, and especially to destroy or obstruct the railway line Liaoyan—Taschetchao—Yinkau.

General Mischtschenko's Raid.—General Mischtschenko who was entrusted with this, assembled 68 squadrons and sotnias, 3 H.A. batteries, and ½ battery field guns carrying common shell, with mounted detachments, at Syfantai on the 8th January.

He decided to march to Yinkau in three columns:—

Right—Lieut.-General Samsonov, 16 squadrons, 10 guns.

Centre—Major-General Abramov, 22 sotnias, 6 guns, and transport.

Left—Major-General Teleschov, 30 sotnias, 6 guns, 4 machine guns.

General Mischtschenko knew that Japanese mounted patrols had penetrated between Syfantai and Auschilian, and that about 3,000 Chunchuses were rendering the country between the Hunho and the Liaoho unsafe. The rivers were hard frozen.

The columns started on the 9th January and reached Tawan, meeting with no foes but Chunchuses. On the 10th they reached Kaliho, where they heard that Newchang was feebly occupied by the Japanese, but Harchong and Yinkan were more strongly held. On the 11th, Newchang was occupied; the Taitseho was crossed at Kaulifan, and attempts made to damage the line, the telegraph, etc.

†About 9 kilometres from Mukden, south of the Hunho, and of the branch Railway.—E.G.

General Mischtschenko had projected taking Yiukau on the 12th, but starting late, the main body only reached Tsianschitsiotsy (6 kilometres from the station) by 4 p.m. At 4.45 the artillery opened fire on the Japanese holding the buildings, etc., some of which were set on fire. As darkness came on, Colonel Charanov attacked with 25 dismounted sotnias. The attack failed because the artillery had to cease fire on the close attack. General Mischtschenko then gave up the attack and retired to Takauken. On the 13th the Japanese sent a mixed detachment out from Haichöng to try and cut off the Russian retreat; but the latter, avoiding Newchang, crossed the Liaoho between Sanchaho and Dunhoyan. The eastern column, which was harassed by the Japanese, retreated to Simuputshönski. The next day they were again assailed, but made good their retreat to Shaling.

The Japanese here lost touch of them, so they succeeded in reaching the Liao-ho on the 16th, and the whole corps was reassembled at Kalioania on that day, where it remained till broken up on the 19th, sending 2 Cossack divisions with infantry supports under General Kossogowski to reconnoitre the country between the Hunho and Liao-ho again. This raid cost the Russians 7 officers and 73 men dead, 32 officers and 237 men wounded, 27 men missing; 144 horses were lost.

The Battle of Sandepu.—General Kuropatkin had moved his force more to the westward, and consulted his three army commanders as to a further offensive movement. These agreed to attack Oku's left flank, Yantai to be the general point of direction. Seven army corps out of the twelve were to carry this out.

On the 19th January Kuropatkin issued his orders, the object being, he said, to drive the Japanese behind the Taitseho and inflict as much loss on them as possible. Elaborate directions were given to each corps commander; the movements were to be regulated by those of the 2nd Army (Grippenberg). An army reserve of 4½ divisions was kept in hand. It was forecast that the Japanese would counter-attack and try and break through the Russian left wing. The 2nd Army (Grippenberg) was to capture the intrenchments from the Hunho along the line Sandepu, Lidiantun, Tingatsi, and after that the fortified posts from Tsunlunyantae to Sadusampu on the Shaho. The Xth Army Corps and 15th Division were only to support it by fire. The weather was very cold—18° Réamar (8·5 Fahr.)—and snow impeded movement. The mornings were misty.

Grippenberg's attack began on the night 24th-25th January. His mounted troops, under Mischtschenko and Kossogowski, crossed the Hunho and moved down eastward towards Sioyho (towards the Shaho). On the 25th-26th his infantry took Hokentin and Toupan. The Japanese Marshal Oyama, who had observed his preparations, had moved the 3rd Division of Oku's army to Yandiawan, to prolong the front. The Russians occupied Huanti and Tsiushantun, and the Japanese advanced troops withdrew to Sandepu and Lidiantun. Their defenders of Hokentai had retired to Kutspöntsi.

The Russian 14th Division did not cross the river, but remained at Tantshau, and the 2nd and 5th Rifle Brigades were advanced there.

The Japanese 8th Division attacked Hokentai, but were heavily repulsed. The General (Tatsumi) was, however, reinforced by two divisions from Shiliho and Landungou. The 14th Russian Division and a brigade of the Ist Siberian Army Corps had attacked Sandepu,

a walled village, bravely defended by a Japanese dismounted cavalry regiment, some companies of infantry, and a battery F.A. The Russians only succeeded in getting possession of the greater part of the village by a night attack on the 27th. The defenders took refuge in a reduit of the interior line of defence, and were here reinforced by two battalions of the Japanese 3rd Division from Yandiawan with machine guns and some artillery. The Russians then attempted to storm the reduit, but were repulsed, and thereon evacuated the whole village of Sandepu, and retired to Tschantau and Tungientoutsy.

The Russian 15th Division took Pitaisy, but did not move forward to support the attack on Sandepu. Others of the Xth Army Corps took Holienbai and Fudiaduan.

On the morning of the 27th January the Japanese 5th Division sent forward a detachment which drove Mischtschenko's cavalry northward out of Sioyio; but the Ist Siberian Army Corps was more successful. Supported by the 2nd Rifle Brigade from Temgentaitsy, it drove the Japanese left out of Samapu to Sautshanpu, but the latter repulsed all attempts of Mischtschenko's cavalry to cut them off.

On the 27th General Grippenberg sent to Kuropatkin for reinforcements, as he did not feel strong enough to succeed in his attacks. The Commander-in-Chief replied that he was strong enough to withstand the attacks of the Japanese.†

On the 28th the Japanese, reinforced by the 15th Brigade of the 1st Army from Landangou, drove back Mischtschenko again westwards, and advanced to the support of the troops about Sumapu; but the Russians, being also supported, that village was taken by them. The Japanese 5th Division had taken Lintiauku.

The commander of the Xth Russian Army Corps decided to advance to Siaotaitz and Labatai, which he occupied without difficulty. To counter this, the 3rd Japanese Division was ordered from Yandiawan, N.E. of Landungou.

General Grippenberg determined on this to make renewed efforts to recapture Sandepu, and again begged Kuropatkin for reinforcements. The latter refused, and ordered him to retire the 2nd Army. General Grippenberg began his retirement early in the morning of the 29th January, fighting heavily with the advancing Japanese, who did not, however, follow him across the Hunho, where the Russian Rifle Corps occupied Tschantau. It was not the intention of Marshal Oyama to pursue, and he ordered the 5th and 8th Divisions to entrench in the line, Sandepu-Hokentai.

The Russians entrenched opposite them on the line, Tschautau-Syfantai, and their advanced troops remained in occupation of Pitaisi-Fuchciduan-Holientai.

The loss of the Russians amounted to 15,000; that of the Japanese in killed and wounded was 8,700.

Only 60,000 men of the Russian armies had been engaged. Their 1st and 3rd Armies made no move during the whole battle, except once on the 28th, when Marshal Oyama made a demonstration against their XVIIth Army Corps, which came to nothing.

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†The account does not state whether Kuropatkin intended him to hold on with the right wing of the Russian Forces, while he pushed forward the centre towards Yentai.—E.G.

THE BATTLE OF MUKDEN.

(Commenced 20th February, 1905.)

The strength of the respective forces engaged were, according to Beiheft 10 of the *Militär-Wochenblatt*, 1905,* to which the Report under review refers its readers, was approximately as under:—

RUSSIANS.	Infty Batns.	Sqdns & sotnias.	Field & Mountn. Guns.	Heavy Guns.	Machine Guns.	Remarks.
1st Army	124	53	356	—	24	About 10 per cent should be deducted from these for casualties before the battle.
2nd "	122	48	356	—	36	
3rd "	76	22	240	—	—	
Reserves	44	2	120	—	16	
Others	4	17	120	2-300	12	
Total	370	142	1,192	2-300	88	About 325,000 Infty. 18,000 Cav. 1,200 F. guns.
JAPANESE.						
1st Army	54*	9	160	—	—	* The Japanese Companies were about 250 strong, 30 over the normal.
2nd "	54	21	270	—	—	
3rd "	42	21	270	—	—	
4th "	54	7	204	—	—	
5th "	29	5	84	—	—	
Reserves and others	30	3	42	170	200	
Total	263	66	892	170	200	About 300,000 Infty. 11,000 Cav. 900 F. guns.

General Baron Kaulbars had taken over command of the 2nd Army from General Grippenberg, who had resigned and returned to Russia. The Russian Army occupied strongly intrenched positions extending from Syfantai through Tschantan, Fudiaduan, Wietschanlin, Shahopu, Bianyupusa, as far as the Kautulin Pass—a frontage of 45 miles. The Ist Siberian Army Corps, strengthened by half of the 6th Siberian Rifle Division, was in reserve behind the 2nd Army. The 3rd Army, commanded by General Baron Bilderling, gave over half of its VIth Siberian Army Corps to the general reserve, under Kuropatkin; the 1st Army had its reserve at Fuschun. In the eastern mountain district, General Alexiev had 18 battalions, 18 squadrons, and 6 batteries at Tsinhochin and Tsindonyai. The Madritov detachment occupied Tunhuasian.

THE JAPANESE FORCES.†

On the 20th February General Nogi had, with the 3rd Army reached the neighbourhood of Siaoteiho; the 2nd Army (Oku) extended

*It is, of course, impossible to reproduce the fine large scale maps published (separately) with the Beiheft. A general map is given in Von Löbell, p. 443.—E.G.

†The strategical deployment of the Japanese forces for the battle of Mukden is made the subject of a short study by Lieut.-General von Kaemmerer in the *Militär-Wochenblatt*, No. 147, of 30th November, 1905, which is well worth reading.—E.G.

thence by Tutaitsy to Sinshinpu. Then came the 4th Army (Nodzu). Far further to the right (east) was the new 5th Army (Army of the Yalu), under General Kawamura, who had the 11th Division and two reserve divisions attached to his force.

On the 19th February Kuropatkin had determined on a fresh offensive stroke. The manœuvre of Sandepu was to be repeated. The Japanese were to be attacked there on the 25th, and gradually driven eastwards. The 2nd Army was again to bear the chief burden, the other two armies merely making demonstrative artillery attacks. It did not, however, come off, for the Japanese themselves took the offensive.

On the 21st February the 5th Japanese Army drove back General Alexiev from Tsinhochin and Tsindouyui to Ulunko and Sanlunyui, General Kuropatkin had given up his projected attack, and had moved half the 6th East Siberian Rifle Division, the Ist Siberian Army Corps, and the 72nd Infantry Division eastwards, being deceived by false reports of the move of the Japanese reserves in that direction. General Linievitch was given the command of the Russian reserves, and Rennenkampf relieved Alexius. On the 25th the Japanese 5th Army reached the Sitchaunlin and Dalin passes. Of their 1st Army (Kuroki), the 2nd Division marched to Sekorei. The 12th Division pushed forward its 12th Brigade east of Tchantesai, and left its 23rd at Bianupusa. The Guard Division had taken on that day a Russian advanced position at Fyndiapu and beaten off a Russian attack at Yansintine.

On the 27th February the 5th Japanese Army was checked at Ditu and Uboniulu. The 3rd Brigade took some advanced works of the Russians east of the Wanfulin pass. The 4th Army opened a heavy artillery fire on the Novgorod and Putilov Hills.† The 2nd Army, on its left, remained purposely inactive.††

The 3rd Japanese Army was meanwhile quietly working round the right flank of the Russian forces, and had, with its cavalry, reached the valley of the Liaoho, while its leading infantry division arrived on the line, Mamykai-Kaliaama.

The Russian cavalry, in advance of their flank, had reported their march, and when Kuropatkin heard of the arrival of other Japanese troops at Sinmintun by rail, he sent forward General Bärger's brigade of the XVIth Army Corps in that direction to reconnoitre.

On the evening of the 28th February General Nogi's army reached the line, Tataitsz-Tuyituan, his 9th Division being in touch with the Russian right wing.

On the 1st March this division was ready to envelop it at Syfantai, while the 2nd Cavalry Brigade was pushed forward to Tamintun.

Kuropatkin, recognising the danger, had moved the rest of the XVIth Army Corps towards Salinpu††† on the 28th February, and

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†Near Shahopu.—E.G.

††It will be noticed that the activity of the Ist Army, supported by the artillery of the 4th, together with the widespread movement and constant attacks of Kawamura had the effect of drawing Kuropatkin's attention off from the real turning movement with Nogi's Army against his right, supported eventually by the 2nd Army. That the turning movement struck too soon, may have been caused by its being discovered.—E.G.

†††About 20 miles N.E. of Syfantai.—E.G.

that night he started off a mixed division of the Xth Army Corps from Siachetun† in support.

A detachment of the 5th Japanese Army occupied Tondago; the 3rd Brigade of the 2nd Division was in the Kantulin pass.

Kuropatkin ordered the 2nd Russian Army to retire on the 1st March, fighting, covered by the Kossagowski Brigade, West Detachment, the mixed Rifle Corps, and the VIIIth Army Corps; it shook itself free, and reached, early on the 2nd March, the line, Tunnandou†† Suhudiapu-Lutai.

The 7th Division of Nogi's Army swung round to Tyashiyinsa-Tasypu; the 2nd Cavalry Brigade reached Tsaodyatai. The 8th and 5th Divisions of the 2nd Army (Oku) took up the line, Santaitsy-Tsewörpu-Wutiasy. The 4th Army extended its left towards the latter, but there was a gap of 4½ miles, which was filled by a mixed detachment of 3 battalions, 6 squadrons, 2 batteries.

The Russian 25th Division and the Schatilow Division attacked Salinpu, but were repulsed somewhat in disorder to the entrenchments at Niusiantun-Yansytun-Madiapu Barracks.†††

The 2nd Army, bringing its left round, attacked the Russian Xth Corps, which retired, and the main body of the 3rd Russian Army then took up the line running S. from the bend of the Hunho to Tasudiapu and Kudiasa, and Kuropatkin utilised the night of the 3rd to organise the defence of his western front.

The 3rd Japanese Army (Nogi) marched towards the Mukden railway station, their cavalry Division being now united at Tschönsintaisa; but on the 4th, General Nogi was ordered to push farther north, and the Japanese Army to move closer to him. On the 5th March Kuropatkin wished to again take the offensive against the Japanese left wing, but early in the morning of the 5th so furious an attack was made by the 2nd Japanese Army (Oku) on Yansytun, Satosa, and Madiapu, that he postponed this till too late, and on the night of the 5th the 3rd Japanese Army carried out successfully its northerly movement, though attacked on the march by the Russians.††††

On the 6th March General Baron Kaulbars, commanding the Russian troops to the west of Mukden, had planned and made a great counter-attack with 3 columns by Taschitschao to Yansytun to cover the Russian retreat, opening it with a heavy fire of 160 guns; but the attack of the right column failed, and the others were not

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† 5 miles E. of Madiapu.—E.G.

†† 3 miles W. of Madiapu.—E.G.

†††This seems to have been a pure frontal attack, without any flank attack from the North, which General von Kaemmerer thinks might have been attempted and successful if properly arranged and combined. —E.G.

††††This was done by an awkward prolonging of the line, the 9th Division disengaging and passing to the rear of the 1st Division, the place of which, on the extreme left beyond Taschitschao, it took. General von Kaemmerer suggests that if some troops had been taken from the first from the General Reserves, in the Japanese centre, this would have been unnecessary, and the Japanese victory would have been much more decisive.—E.G.

persevered with. The Russian heavy artillery and train was meanwhile sent off eastward in retreat.

On the 7th March the 3rd Japanese Army, under General Nogi, pressed forward and pushed back the Russian right wing to Ninsiantun, but the latter held its own from that village to the Hunho.

South of the Hunho parts of the 5th Division (2nd Japanese Army) and of their 4th Army (Nodzu) drove back the Russians from Madiapu, Suyatun, and Shahopu, but were not able to make any further progress thence to the Kantulin Pass.

On the night of the 7th March General Kuropatkin ordered the troops defending the southern front to retire as far as the N. bank of the Hunho, south and east of Mukden. General Rennenkampf retired to Yinpan (N.E.) and Fuschun (N.). By the evening the mass of the 1st Army had effected its retreat, and had left strong rear guards to defend the passages.

The 5th and 1st Japanese Armies followed them up that morning, but got no farther than Lientaowan† and Liukiatsy†† that evening.

The Russian retreat by Shahopu and Madiapu on the 7th was more difficult; but, not being hard pressed by the Japanese, they reached the Hunho, crossed it, and prolonged the line of the Russian right north of Mukden, leaving rearguards to defend the bridge-head on the southern bank.

The Japanese 4th Army (Nodzu) followed them up on the 8th, reaching Baimatsy and Baitapu.

North of Mukden Kuropatkin prolonged his right and reached Wunitun station, the attacks of the 3rd Japanese Army having failed to prevent this. They were only able to deploy for attack at Siaohantun on the night of the 8th March. Their cavalry were engaged that night with the Russian cavalry (both in dismounted action) at Hausientun. That night Kuropatkin gave orders for the retreat to Tielin. The wounded, trains, and rolling stock began to get under way early on the 9th. On this day a violent duststorm enabled the Russians to make good their retreat and the Japanese to correct the position of their 3rd Army. The 9th Division of this corps was disentangled from the general line of advance N.E., and directed to march on Schonkontsu; the 7th Division to Siashantun.††† But they could not overtake the Russians, and no fighting took place, nor was the bridge-head south of Mukden attacked that day. The Russian rear guards held back the 5th Army and parts of the 1st on the 10th, so that the latter could not get their artillery beyond the line, Sintun-Puho-Tawa, to molest the retreat, which was continued north along the great Mandarin road and railway, the greater part escaping, but a strong rear-guard, under General Havenfeld, was practically annihilated by the 6th and 4th Reserve Divisions of General Nodzu's army at Wansytun.††† On the N.W., Russian rear guards still held the Schonkontsu station and the Tuntschöntsy bridge north of the Puho river on the night of the 10th March.

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†11 miles South of Fushun, on the Hunho.

††3½ miles South of the Hunho, by Holundian.—E.G.

†††An examination of the map will show the error made in directing Nogi's 3rd Army too soon to the N.E.—E.G.

††††South of the Hunho bridge-head.—E.G.

The great battle was over. It had cost the Russians 2,457 officers and 94,153 men in killed, wounded, prisoners, etc. The Japanese lost 41,000 altogether in killed and wounded. They took 2 colours and 58 guns, besides much other *matériel* and many stores.

Kuropatkin had made good his retreat to Tielin, but instead of making a stand there he decided to continue his retreat.

The 2nd and 4th Japanese Armies remained in occupation of Mukden. The 12th Division of Kuroki's force reached Yilu† on the 11th, fighting with the Russian rear guards and capturing some 2,300 more prisoners. The 2nd Division of the 5th Army reached Hokatou on the 12th. On the 12th March the 3rd Army took up the pursuit, also on the left, and reached the Yiluho on the 14th.

On that day the Russians retired through Tielin, followed by the 2nd Division, who occupied it on the 15th March. The 12th Division then took up the lead, and had some severe fighting at Zungu.

General Kuropatkin was recalled on the 15th March, the command of the forces being conferred on General Linievitch, who gave the army a day of rest on the 20th March before retiring to the Sipingai position.

On the 19th March the Japanese 4th Army was pushed forward in support and occupied Kaiyuantschön; the 1st Army was between Tielin and the Fanho, the 2nd Army being left at Mukden. As the pursuit was thus relaxed, General Linievitch continued the Sipingai entrenchments which had been already thrown up to cover the retreat, and reorganised his forces, distributed his reinforcements, etc. General Rennenkampf was retiring north towards Kirin in rear of the left flank, and was at Hailuntschön.

On the extreme right General Mischtschenko, who was covering the Russian right with a cavalry corps, made several raids against the Japanese communications, without, however, effecting much.

On the 17th June the Japanese counter-attacked and drove him out of Sanganwopin. By the end of June the Russian army was quite re-established.

The Report then briefly narrates the naval events, and carries the account down to the peace negotiations, beginning (after the armistice on the 29th August) on the 1st September and in Manchuria on the 16th, ending with the signing of the peace on the 15th October and its conditions, which are well known to our readers. The losses and costs of the war are given, and a copious list of works on the war. It is to be regretted that no comments are made on the operations throughout. Perhaps these are only postponed till next year.

IV.—MILITARY OBITUARY, 1905.

The Report brings to notice, with short biographies, the deaths of many German and other officers during the year.

The following, being well known to most British officers, are epitomised:—

Lieut.-General Albert von Boguslawski, who died at Berlin, in September, aged 71. He took part in the campaigns of 1864, 1866, and

†On the Yiluho, 20 miles N. of Mukden.—E.G.

1870-1. In 1869 he published the 1st Vol. of his "Development of Tactics from 1793 to the Present Time." After 1871 he wrote his well-known "Tactical Deductions." He was promoted Major-General in 1887, when in command of a brigade, and retired in 1890 as Lieut.-General. At Wörth and Mt. Valérien he distinguished himself so much that he was awarded both classes of the Iron Cross. His warlike energy was only equalled by his untiring industry with which he set an example to all, and his works were as well known abroad as in Germany.

Major Hermann Kunz, well-known to British officers by his valuable tactical studies of the Franco-German war, died suddenly at Berlin in October, 1905, aged 48. He served in the campaigns of 1866 against Austria, and 1870-1 against France. He passed the Staff College, and was appointed Instructor in Tactics at the Cadet College. From 1884 to 1886 he served on the General Staff. He retired in 1888, and devoted himself to energetic military studies of campaigns since the Crimean war, with a view especially to the correction of the hitherto published accounts of the battles of the Franco-German war in *Kriegsgeschichtliche Beispiele.* He was a highly esteemed collaborator in *Von Löbell's Jahresberichte*, for which he wrote the account of the German operations in S.W. Africa which appears in the present volume.

The other obituary notices include Generals M. Dragomirov, Kondratenko (Port Arthur), Count Keller, of Russia, Lieut.-General Matsumura, Commander of the 1st Division, Japan, Generals Saussier and Thibaudin, of France. An account of the military services of the late Grand Duke Sergius is also given.

V.—MILITARY LITERATURE.

The following among the many military works, etc., published in 1905 are brought to the notice of officers studying German and French military literature of the day in the originals:—

General, Military History, etc.

Kriegsgeschichtliche Einzelheiten (Episodes of Military History, Vols. 34-35†). "*The South African War, 1899-92.*" Published by Section I. (Historical) GERMAN GENERAL STAFF. "*The Battles in Natal after Colenso, and the Events in the Orange Free State, etc., in 1900.*"

"*L'esprit de la Guerre Moderne.*" By GÉNÉRAL BONNAL. "*La Manœuvre de Landshut, 1808-1809, étude de Stratégie et de Psychiologie.*"

THE FRENCH GENERAL STAFF WORK OF THE WAR OF 1870-71.—"*La Bataille de St. Privat.*" (Paris, 20 francs.)

P. LEHAUCOURT.—"*Rezonville et St. Privat.*" (Paris, 7·50 francs.)

†Reviewed in the JOURNAL for July, 1906, p. 965, *et seq.*—E.G.

General, Military History, etc.— *continued.*

HENRI HOURSAGE.—"*La Seconde Abdication,*" etc.

LOUIS NAVEZ.—"*Pendant et Après Waterloo.*"

"*Die Erzieter des Deutschen Heeres.*" GENERAL VON PELET-NARBONNE. Vols. 1, 3, 5, 7. These include Biographies of Der Grosse, Kurfürst, Friederich der Grosse, Scharnhorst, Clausewitz.

"*Kriegsbriefe aus der Mandschurei.*" COLONEL GÄDKE.

"*Trois Mois avec le Maréchal Oyama.*" By VILLETAIN DE LANGUÉRIE, an experienced war correspondent.

"*Trois Mois avec Kuroki.*" C. V. THOMAS (a retired officer).

"*Einzelschriften über den Russisch-Japanischen Krieg.*" STREFFLEURS MILITÄR ZEITUNG; aus offiziellen daten.

"*Die Schlacht bei Mukden* (BEIHEFT ZUM MILITÄR WOCHENBLATT). A continuation of MAJOR IMMANUEL'S 3 Vols.

"*Tactische und Strategische Lehren des Russich-Japanischen Krieges.*" MAJOR LÖFFLER, Berlin, M. 3. (Reprinted from the *Viertelsjahrheften*, Berlin.)

FRONTAL ATTACK AND INFANTRY FIRE-SUPERIORITY.

Translated from the *Militär-Wochenblatt.*

THE increased difficulty of the frontal attack caused by the development of fire action, has rendered it necessary to investigate what preliminary conditions must in future be fulfilled for its success, and has made it appear desirable to condense into as simple and clear a formula as possible, the deductions drawn from the above-mentioned investigations.

These conditions were considered fulfilled by the application of principles determining artillery tactics, and these principles were expressed in one word which was likewise borrowed from artillery tactics, viz., "Fire-Superiority." This expression found admission into our regulations and became a shibboleth in tactical criticism. In this regard we might ask the question whether this word expresses as smoothly and clearly, as it sounds, the conditions for tactical success, especially as regards the success of the infantry attack. In artillery action the term "fire-superiority" means "greater fire-efficacy," which renders it possible to keep down or silence the hostile fire, either for a given time or at given places. It will, of course, be rarely possible to attain to this latter highest degree of superiority over the whole of the enemy's fire; it would not even be necessary; a less degree would suffice to so hold the enemy down that it would become possible to use the surplus force for other purposes, viz., for the decisive infantry action.

Thus the term "fire superiority" is suitable for artillery action, for it is essentially "greater fire-efficiency" which will be striven for, and thus expressed. It is, however, a question whether the same or similar conditions obtain in infantry action, and if the use of that term is applicable in this instance.

Whilst the artillery fight is exclusively one of fire and long-range action, the infantry fight consists of fire action and forward movement. The decisive action results from our forcing the enemy to give way to our tenacity, and is finally alone expressed by his retreat. Fire alone, however, cannot bring about this result except under altogether exceptional conditions; it must be supplemented by the advance, by the menace of short-range fire with its attendant heavy losses, or of the annihilating bayonet attack. The infantry fight is thus based on the forward movement; the fire action should make this possible, in spite of the enemy's fire. Is "fire superiority" necessary for this? In other words, does a preponderance in fire power or efficiency of fire action result from the adjustment of the number of rifles brought into nne on both sides, from the losses suffered, or from the moral effect produced on both sides? All these questions may be answered in

the negative. It isn't a question of a preponderance, but of altogether relative matters; in order that the advance may be possible the defender's fire must be stifled and kept down, or reduced by the efficacy of the attacker's fire to such an extent that the inevitable and ever-increasing losses may be sustained by the latter without diminishing his *moral*, and that they stand, moreover, in proportion to the tactical object pursued.

We thus see here nothing decisive, nothing which may be condensed into a formula, but everywhere reciprocal relations of moral forces, the effects of which can, of course, frequently only become manifest through success or failure. Here, as always in war, calculation must be combined with daring, where, however, most of the chances are in favourable proportion to the success anticipated; risks are always justifiable in war.

We are, consequently, of opinion that it is impossible to express, by means of a technical formula, those conditions which are necessary for the success of the frontal attack. And especially the attempt to do this by use of the expression "infantry fire-superiority" runs the danger of introducing the idea into our Army that the material factors, viz., numerical strength and losses, are the decisive elements in battle. If the battle is regarded exclusively from such points of view, the conclusion must necessarily be arrived at that the defensive, at the present day, has attained such power that the frontal attack has but small chance of success. This would, however, be at once an admission of the superior power of the defensive. Thanks, however, to our deep-rooted, ancient Army traditions, this idea has had but little success hitherto. We may contribute to the maintenance of ancient traditions by drawing attention to a point of view which is not sufficiently regarded in tactical considerations on the advantages of the defensive and the difficulties of the frontal attack. Perhaps the thought may be sufficiently clearly explained as follows: the passive defensive is acknowledged by everyone as useless to ensure decisive results. This is one of those tactical axioms which are so universally recognised that they are accepted without any demand being made for a proof of their correctness. "Passive resistance can only gain time," says the completion of that axiom. Now every defensive, which is expressed by its fire alone, with the object of clinging to a particular piece of country, presents, during the period of such action, all the peculiarities and disadvantages of a passive defensive. Let us recall what these disadvantages are. We would merely point out that the very fact of abandoning the advance and the attack constitutes an admission of weakness, which has a disastrous influence on the *moral* of the troops, and that the defenders' confidence in themselves will become still further weakened by the small success of their fire at the commencement of the action; this, combined with their own first losses, will set up an excitement which has such a harmful effect on the defenders' coolness and presence of mind.

What, however, inevitably induces the defenders' complete moral breakdown is being tied to the position. The effects of the enemy's fire, the losses falling thickly round us, cannot pass unnoticed; those who are no longer capable of movement, cause an indelible impression; and, as in most cases it will be impossible to care for the wounded in the fighting line itself, it is even desirable that that depressing influence should be removed, therefore the dispatch to the rear of

the severely wounded of the defending force, and the retirement of the wounded, still capable of fighting, cannot be forbidden and cannot even be controlled. From thence there arises a great temptation for those men who have become demoralised, and it is only a question of time when the moment will come when even the good element will have lost all confidence in the possibility of steadiness and resolution.

On the other hand, the *moral* of the attacker, in spite of his probably numerically superior losses, is infinitely better; in the very advance lies an expression of self-confidence and a source of energy; that there are losses is not unexpected; as far as they are observed generally, their impression is by no means permanent; one ceases to notice them. In addition, it is far easier to rush forward under the influence of the enemy's fire—the excited nerves are thus given the desired relief—than to retain the coolness and presence of mind necessary for efficacious fire; the attacker, too, from the great number of hostile bullets going over his head, has the feeling of diminishing the danger of his advance by "running under" the enemy's fire. Even the strengthening of the fighting line, which occurs during the attack, and which naturally facilitates and increases the efficacy of the enemy's fire, should not be altogether regarded as a source of losses; it is also a well-tried, efficacious means of raising the confidence of the assailants, whilst with the defender, the strengthening of his firing line, which should increase the efficacy of his fire, will frequently be merely the strengthening of a fire of but little power, for, according to old experience, the defender feels safer in a thin fighting line and more easily retains his coolness, but in thick firing lines he labours under the vague feeling that the defenders' numbers attract the enemy's bullets.

Thus, many tactical doubts and mysteries are solved by the consideration of the working of moral influences in battle, and we come to the following conclusion, from the considerations advanced:—

The preliminary condition for the success of an infantry frontal attack is fulfilled when, by the attacker's fire, that of the defender is so weakened in quality that the attacker remains able to support the losses he is still undergoing, and that the latter are in proportion to the importance of the situation and to the object of the battle. It cannot always be known if this condition is fulfilled. If one is, therefore, of opinion that the risk contingent on a further advance cannot be supported, one must await those influences, which must infallibly make their appearance with the defender; one should, at the same time, not lose sight of the fact that with the decrease in the risk the greatness of the result is also diminished; for the attacker, who endeavours solely, by means of his fire, and with the help of time, to drive the passive defender out of his position, must not be astonished at meeting him again behind the next fold of the ground; a success of this nature will, however, seldom suffice to fulfil the attacker's object.

In the future, therefore, as in the past, the frontal attack is necessary, and must also be recognised as possible, when proper account is taken of the moral weaknesses of the defensive. We should thus steadfastly cling to the glorious old Prussian doctrine, which has lately found striking expression in the words:—

"Courage is the best weapon—courage which is infectious; therefore, every attack is accompanied by music."

NAVAL NOTES.

HOME.—The following are the principal appointments which have been made:—Admiral Sir Day Hort Bosanquet to be Commander-in-Chief at Portsmouth. Rear-Admiral—F. S. Inglefield to Command of the Fourth Cruiser Squadron. Captains—Sir G. T. S. Warrender, Bart., C.B., M.V.O., to be Commodore of the 1st Class, to Command East India Station; A. A. C. Galloway to be Commodore of the 2nd Class, in Command of R.N. Barracks, Portsmouth; F. E. Brock to be Commodore of the 2nd Class, in Command of R.N. Barracks, Devonport; C. S. Hickley to "Highflyer"; F. W. Kennedy to "Amphitrite"; the Hon. S. Hawke to "Thetis"; C. F. Lambert to "Hibernia"; R. F. Scott, C.V.O., to "Albemarle"; D. St. A. Wake to "Hawke"; C. E. Erskine to "Bedford"; W. L. Grant to "Cornwallis"; H. Lyon to "Formidable"; A. W. Heneage, M.V.O., to "Hyacinth"; H. Orpen to "Iphigenia." Commanders—M. F. Sueter to "Barham"; A. T. Taylor to "Imogene."

Admiral Sir G. H. Noel, K.C.B., K.C.M.G., hoisted his flag on the 1st inst. as Commander-in-Chief at the Nore, in succession to Admiral Sir H. L. Pearson, K.C.B., whose period of service had expired. Rear-Admiral R. A. T. Montgomerie, C.B., C.M.G., hoisted his flag on the 1st inst. on board the third-class cruiser "Sapphire" in command of the torpedo and submarine craft flotillas, in succession to Rear-Admiral A. L. Winsloe, C.M.G. Rear-Admiral F. Finnis hoisted his flag on board the battle-ship "Resolution" at Chatham on the 3rd inst. in command of the Sheerness-Chatham Division of the Home Fleet; the same day the flag of Rear-Admiral H. C. F. Niblett was hoisted on board the "Empress of India" at Devonport in command of the Devonport Division of the Home Fleet.

The new first-class battle-ship "Hibernia" was commissioned at Devonport on the 2nd inst. for temporary service with the Atlantic Fleet; she will later be transferred to the Channel Fleet as the flag-ship of Vice-Admiral Sir R. N. Custance, K.C.M.G., when he succeeds Vice-Admiral the Hon. Sir A. G. Curzon-Howe, K.C.B., C.V.O., C.M.G., as Second-in-Command of that fleet.

The new first-class battle-ship "Dreadnought" left Portsmouth on the 5th inst., for an experimental cruise. She arrived at Gibraltar on the 10th inst., and leaves that port eventually for Trinidad, in the West Indies, on 26th January, arriving on 3rd February, a distance of about 3,600 miles, which she will have to do in about 8 days, giving an average of

from 17 to 18 knots speed for the run. She leaves Trinidad again on the 21st March, arriving at Sheerness on the 31st.

The first-class cruiser "Spartiate" left Portsmouth on the 8th inst. with relief crews for the China Station.

Cost of New Cruisers.—The total value of the main contracts for the cruisers named laid down in 1906 in private yards was as follows:— "Inflexible," £1,224,808; "Invincible," £1,253,348 13s. 4d.; "Indomitable," £1,248,072 5s. These figures do not include cost of gun mountings or armament, contracts for which were placed separately.

The New Armoured Cruiser "Shannon."—Want of space has prevented our noticing the launch of this ship earlier, which took place on the 20th September at Chatham. The "Shannon" is practically a sister-ship to the "Minotaur" and "Defence," the first named of the two others having been launched at Devonport on the 6th June, while the "Defence" is still on the slips at Pembroke. There is a slight difference between the three ships, the "Shannon" having a foot more beam and drawing a foot less water at legend weights than her sisters; in length they are the same. The dimensions of the ship are as follows:—Length, 490 feet; beam, 75 feet 6 inches; displacement, 14,600 tons, with a mean draught of 25 feet. The engines are to develop 27,000-I.H.P., estimated to give a speed of 23 knots, steam being supplied by 24 water-tube boilers of the large tube Yarrow type, the normal coal supply being 950 tons, and she will also be fitted for burning oil fuel.

Protection is afforded by a complete steel belt of Krupp hard steel 6 inches thick, tapering to 3 inches at the extremities, which is carried right up to the upper deck without any opening for the guns, the light armour at the ends being widely distributed. The gun positions in the citadel are similarly protected, and the main deck is also armoured with from 1·5-inch to 1-inch steel. The armament consists of four 9·2-inch (50-calibre) guns disposed in pairs fore and aft the citadel, the foremost pair having a higher range of fire, and ten 7·5-inch (50-calibre) guns, disposed half on each side of the ship, three on either broadside, and the remainder at the four corners of the citadel; there are also thirty small Q.F. guns for protection against torpedo attack, with five 18-inch torpedo discharges, two on each beam and one right ahead, all submerged.

The following table will enable a comparison to be made with the previous classes of armoured cruisers in the British Navy:—

Name of Ship.	Date of Launch.	Displacement.	I.H.P.	Speed Knots.	Heavy Guns.
Kent	1901	9,800	22,249	21·7	Fourteen 6-in.
Devonshire	1904	10,850	21,475	22·9	Four 7·5-in, 6 6-in.
Cressy	1899	12,000	21,000	21	Two 9·2-in, 12 6-in.
Drake	1902	14,100	30,000	23	Two 9·2-in., 16 6-in.
Black Prince	1904	13,500	23,940	23·6	Six 9·2-in., 10 6-in.
Cochrane	1905	13,650	23,500	22·5	Six 9·2-in., 4 7·5-in.
Shannon	1906	14,600	27,000	23	Four 9·2-in, 10 7·5-in.

Result of Test of Gunlayers with Heavy Guns in His Majesty's Fleet, 1906:—

—	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
Number of ships that fired	109	139	136	121	127	139	134	108	100	89
Number of guns ...	846	1,010	1,121	1,031	1,137	1,241	1,296	1,171	1,096	1,073
Number of hits ...	2,052	2,527	2,831	2,732	3,562	4,789	5,996	5,748	4,374	5,733
Number of misses ...	4,389	5,436	6,249	5,709	6,244	6,863	7,028	7,664	3,357	2,328
Excess of hits over misses	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	Nil.	1,017	3,405
Excess of misses over hits	2,337	2,909	3,418	2,977	2,682	2,074	1,032	1,916	Nil.	Nil.
Percentage of hits to rounds fired ...	31·86	31·63	31·1	32·3	36·3	41·1	46·04	42·86	56·58	71·12
Hits per gun per minute.										
12-inch and 10-inch VI. and VII.	·09	·23	·29	·30	·33	·38	·53	·47	·58	·81
9·2-inch	·17	·32	·23	·22	·31	·35	·70	·73	1·40	2·84
6-inch Q.F. and B.L.	·89	1·11	1·05	1·51	1·81	2·41	2·63	2·63	4·14	5·68
4·7-in. and 4-in. Q.F.	1·83	1·68	1·82	1·60	1·93	2·02	2·47	2·28	3·73	4·96
Number of ships from whom no returns were received ...	20	33	32	39	47	19	30	43	Nil.	Nil.

ABSTRACT, 1906.

Order of Merit.	Fleet or Squadron.	No. of Ships.	No. of Men Firing.	Points per Man.	First Ship in Fleet.	Scores
1	SECOND CRUISER	6	86	98·741	"DRAKE"	124·49
2	Mediterranean ...	11	137	93·539	"Formidable" ...	118·31
3	Third Cruiser ...	5	60	90·890	"Carnarvon" ...	114·15
4	Atlantic	11	156	88·557	"King Edward VII."	123·09
5	First Cruiser ...	6	68	86·648	"Hampshire" ...	107·52
6	China	6	84	82·228	"King Alfred" ...	102·27
7	Channel	21	288	72·266	"Exmouth" ...	109·03
8	Tenders, etc. ...	4	12	71·096	"Shearwater" ...	104·65
9	Cape of Good Hope	4	39	64·441	"Crescent"	88·13
10	N.A. and W.I. ...	2	16	62·019	"Indefatigable" ...	66·06
11	Australia	9	90	58·507	"Prometheus" ...	84·53
12	East Indies	4	37	56·728	"Fox"	79·02
	Total	89	1,073	80·065		
	Total, 1905 ...	100	1,096	68·26		

Fleet Exercises.—Instructions have been received on board the vessels of the Atlantic Fleet to proceed to the coast of Portugal early in February, there to join the flag of Sir Arthur Wilson, for carrying out the usual annual fleet exercises and tactical manœuvres. The vessels of the Channel and Mediterranean Fleets will also take part in these exercises, nine flag officers being present and upwards of 50 pennants. The total displacement of the armoured vessels at the disposal of the Commander-in-Chief is 625,370 tons. It appears to be uncertain at present if the destroyer flotilla attached to the Channel Fleet will participate, but the scouts "Patrol," "Pathfinder," and "Sentinel" are to do so.

The following is understood to be a complete list of the ships which will assemble at Lagos for the exercises, with the flag officers in command:—

Admiral Sir A. K. Wilson, flag in "Exmouth," in supreme command.

Vice-Admiral Sir W. H. May, flag in "King Edward VII." (Atlantic Fleet).

Vice-Admiral the Hon. Sir A. G. Curzon-Howe, flag in "Cæsar" (Channel Fleet).

Rear-Admiral G. A. Callaghan, flag in "Illustrious" (Channel Fleet).

Rear-Admiral G. Le Egerton, flag in "Albemarle" (Atlantic Fleet).

Rear-Admiral F. C. B. Bridgeman, flag in "Venerable" (Mediterranean Fleet).

Rear-Admiral G. Neville, flag in "Good Hope" (First Cruiser Squadron).

Rear-Admiral H.S.H. Prince Louis of Battenberg, flag in "Drake" (Second Cruiser Squadron).

Rear-Admiral Sir H. D. Barry, flag in "Bacchante" (Third Cruiser Squadron).

Thirty battle-ships—"King Edward VII.," "New Zealand," "Hindustan," "Commonwealth," "Britannia," "Africa," "Hibernia" (16,350 tons), "Venerable," "Formidable," "Implacable," "Irresistible," "Queen," "Prince of Wales," "London" (15,000 tons), "Cæsar," "Prince George," "Jupiter," "Mars," "Illustrious" (14,900 tons), "Exmouth," "Russell," "Duncan," "Cornwallis," "Albemarle" (14,000 tons), "Vengeance," "Goliath," "Ocean," "Canopus" (12,950 tons), "Swiftsure," "Triumph" (11,800 tons).

Sixteen armoured cruisers—"Good Hope," "Drake" (14,100 tons), "Duke of Edinburgh," "Black Prince" (13,660 tons), "Bacchante," "Hogue," "Sutlej" (12,000 tons), "Argyll," "Devonshire," "Hampshire," "Roxburgh," "Antrim," "Carnarvon" (10,850 tons), "Berwick," "Lancaster," "Suffolk" (9,800 tons).

Eleven protected cruisers.—"Arrogant" (5,750 tons), "Dido," "Juno," "Diana," "Venus" (5,600 tons), "Minerva" (5,600 tons), "Topaze," "Amethyst," "Diamond," "Sapphire" (3,000 tons), "Barham" (1,830 tons).

Three scouts—"Pathfinder," "Patrol" (2,940 tons), "Sentinel" (2,895 tons).—*The Times* and other sources.

General.

The war-ships, exclusive of torpedo-boats and submarines, launched during the year 1906, with their tonnage, I.H.P., and estimated speed, were as follows:—

Great Britain.—First-class battle-ships—"Dreadnought," 18,000 tons, 23,000-I.H.P., and 21 knots speed; "Lord Nelson," "Agamemnon," 16,500 tons, 16,750-I.H.P., and 18 knots speed. First-class armoured cruisers—"Minotaur," "Shannon," 14,600 tons, 27,000-I.H.P., and 23 knots speed. Torpedo-boat destroyers—"Gadfly," "Glow-worm," "Cricket," "Dragonfly," "Firefly," 230 tons, 4,000-I.H.P., and 26 knots speed.

Austria-Hungary.—Torpedo-boat destroyers—"Ulan," "Streiter," "Wildfang," 400 tons, 6,000-I.H.P., and 28 knots speed.

France.—First-class battle-ship—"Verité," 14,865 tons, 18,000-I.H.P., and 18 knots speed. First-class armoured cruiser—"Ernest Renan," 13,644 tons, 36,000-I.H.P., and 23 knots speed. Torpedo-boat destroyers—"Claymore," "Cognée," "Mortier," "Obusier," 336 tons, 6,800-I.H.P., and 28 knots speed.

Germany.—First-class battle-ships—" Schlesien," " Schleswig-Holstein," 13,250 tons, 16,000-I.H.P., and 18 knots speed. First-class armoured cruisers—" Scharnhorst," " Gneisenau," 11,600 tons, 26,000-I.H.P., and 22 knots speed. Second-class cruisers—" Stuttgart," " Nürnberg," 3,450 tons, 13,000-I·H.P., and 23 knots. Torpedo-boat destroyers—12 (two divisions), 480 tons, 6,000-I.H.P., and 28 knots speed.

Greece.—Torpedo-boat destroyers—" Nike," " Storm," 390 tons, 8,000-I.H.P., and 30 knots speed.

Italy.—Torpedo-boat destroyers—"Artigliere," " Granatiere," " Lanziere," " Bersagliere," 375 tons, 6,000-I.H.P., and 29 knots speed.

Japan.—First-class battle-ship—" Satsuma," 19,350 tons, 27,000-I.H.P., and 18 knots speed. First-class armoured cruiser—" Ikoma," 13,750 tons, 20,500-I.H.P., and 20 knots speed. Second-class cruisers—" Tone," " B," 4,100 tons, 15,000-I.H.P., and 23 knots speed. Third-class cruisers—" Magami," " Yodogawa," 1,350 tons, 8,000-I.H.P., and 23 knots speed. Torpedo-boat destroyers — " Hayate," " Yunagi," " Schigura," " Hatsuharu," " Yudachi," " Mikazuki," " Nowaki," " Schiratsuhu," " Schirayuki," " Matzukarie," " Schirotaje," " Hibiki," " Hatsuyuki," 386 tons, 6,000-I.H.P., and 29 knots speed.

The Netherlands.—Battle-ship—" Jacob van Hoemskerck," 5,000 tons, 6,000-I.H.P., and 16 knots speed.

Peru.—Torpedo-cruisers—" Almirante Grau," " Coronal Bolognesi," 3,200 tons, 14,000-I.H.P., and 24 knots speed.

Russia.—First-class battle-ships—" Andrei Pervozvannui," 16,630 tons, 17,600-I.H.P., and 18 knots speed; " Iohann Zlatoust," " Evstafi," 12,950 tons, 10,600-I.H.P., and 16 knots speed. First-class armoured cruisers—" Rurik," 15,000 tons, 19,700-I.H.P., and 21 knots speed; " Admiral Makaroff," " Pallada," 7,900 tons, 16,500-I.H.P., and 21 knots speed. Torpedo-boat destroyers — " Amuretz," " Ussuritz," 580 tons, 6,500-I.H.P., and 27 knots speed; " Deiney," " Dejatchug," " Dortoiny," " Rastoropny," " Rasjaschtschy," " Storoschewoi," " Silny," " Stroiery," 350 tons, 6,000-I.H.P., and 26 knots speed.

Spain.—Second-class cruiser—" Reina Regente," 5,350 tons, 15,000-I.H.P., and 21 knots speed.

United States.—First-class battle-ship—" New Hampshire," 16,250 tons, 16,500-I.H.P., and a speed of 18 knots. First-class armoured cruisers —" Montana," " North Carolina," 14,500 tons, 23,000-I.H.P., and a speed of 22 knots.

France.—*The Disposition of the Naval Forces, 1907*.—The armoured cruiser division, under the command of Vice-Admiral Richard, consisting of the three sister first-class armoured cruisers " Montcalm " (flag-ship), " Amiral Gueydon," and " Dupetit Thouars," which has been recalled from China, arrived at Brest on the 27th ult., Vice-Admiral Richard striking his flag on the following day. The passage from Port Said and Algiers was only made at a speed of 9 knots, the " Montcalm " having lost two out of her three screws, and she is to be paid off and placed in the dockyard hands for repairs.

The "Amiral Gueydon" and " Dupetit Thouars" are to join the Squadron of the North, and with the first-class battle-ship " Masséna," on which Vice-Admiral Gigon is flying his flag, will form the 1st division of the squadron, the 2nd division being composed of the first-class armoured

cruisers "Gloire," "Jeanne d'Arc," and "Dupuy de Lôme." Vice-Admiral Gîgon is to continue to fly his flag in the "Masséna" until the "Montcalm," after her repairs, is ready to take her place as flag-ship, when the "Masséna" will proceed to the Mediterranean to join the 2nd Squadron, and the Squadron of the North will then consist only of armoured cruisers, in accordance with the new distribution of the fleet.

In accordance also with the new arrangements, Rear-Admiral Philibert, who commands the 2nd division of the Squadron of the North, consisting at present of the coast-defence battle-ships "Bouvines" (flag-ship), "Amiral Tréhouart," and "Henri IV.," is to succeed Admiral Puech in the "Gloire," the last-named officer vacating the command of what has been the Cruiser Division of the Squadron of the North on its becoming the 2nd division of the squadron. The "Bouvines" and "Amiral Trehouart" are to pay off at Cherbourg, on the 15th inst., while the "Henri IV." and the two remaining battle-ships of the Squadron of the North, the "Jauréguiberry" and "Carnot," are to proceed to the Mediterranean.

The following will be (according to the proposals in the Budget) the distribution of the Home Squadrons for the present year:—

1st Squadron, in the Mediterranean.

First-class battle-ships—"Suffren," "Patrie," "République," "Jéna," "Saint Louis," "Gaulois."
First-class armoured cruisers—"Jules Ferry," "Léon Gambetta," "Victor Hugo."
Second-class cruiser—"Du Chayla."
Third-class cruiser—"Lalande."
Destroyers—"Faucon," "Lahire," "Claymore," "Mortier," "Carquois," "Carabine," "Contelas," "Sarbacane," "Glaive," Arbalête," "Poignard."

The battle-ships and cruisers will be in full commission for the whole year; of the destroyers, the first five will be in full commission for the whole year, the remainder for shorter periods.

2nd Squadron, in the Mediterranean.

First-class battle-ships—"Masséna," "Carnot," "Jauréguiberry," "Charles Martel," "Bouvet," "Charlemagne."
First-class armoured cruisers—"Marseillaise," "Condé," "Amiral Aube."
Third-class cruiser—"Galilée."

The three first-named battle-ships and the armoured cruisers will be in commission for the whole year with a special reduced complement; the three remaining battle-ships will be *en disponibilité armée* with corresponding complements during the year, while the "Galilée" will be in full commission.

3rd Squadron, in the Channel.

First-class armoured cruisers—"Montcalm," "Amiral Gueydon," "Dupetit Thouars," "Gloire," "Jeanne d'Arc," "Dupuy de Lôme."
Third-class cruiser—"Forbin."
Destroyers — "Cassini," "Tromblon," "Stylet," "Pierrier," "Obusier," "Trident," "Bombarde," "Baliste," "Fleurat."

The whole of the cruisers will be six months in full commission, and with special reduced complements for the other six. Of the destroyers, five will be in full commission for the whole year, and the remainder for shorter periods.

New Ships.—The new first-class battle-ship "Patrie" has been making some further coal-consumption trials. With the engines developing 3,370-I.H.P. and making 60 revolutions, the speed obtained was 10·4 knots, with a coal consumption of 656 gr. (1·44 lb.) per I.H.P. per hour. With the engines developing 7,364-I.H.P. and making 76 revolutions, the speed obtained was 15·2 knots, with a coal consumption of 739 gr. (1·62 lb.) per I.H.P. per hour.

The new first-class battle-ship "République" was commissioned at Brest on the 1st inst. for service in the Mediterranean Squadron, and she is to carry out some long-distance trials during her passage to Toulon.

The new first-class armoured cruiser "Jules Ferry" has been continuing her trials successfully. At an official three hours' run at full speed, with the engines developing 28,695-I.H.P., and making a mean of 123·5 revolutions, a speed of 22·8 knots was maintained. At a further trial for ten hours at full speed, the engines developed 28,573-I.H.P. (mean), making 125·5 revolutions, with a mean speed of 25·5 knots, the coal consumption being 186 kg. (410 lbs.) per square metre of grate surface, and 836 gr. (1·81 lb.) per I.H.P. per hour.

The new first-class armoured cruiser "Victor Hugo" has completed satisfactorily her first preliminary trials. At the ten hours' trial at 16,000-I.H.P. the actual power developed was 17,500—an excess of 1,500 over the contract—giving a mean speed of 20·8 knots; at a final full-speed trial a speed of 22·8 knots was attained. The official trials will begin this month.

Last April, in accordance with the Vote of the Chambers, it was decided that six battle-ships of 18,000 tons should be laid down during 1906, instead of three, as already proposed in the Estimates. Two of these, the "Danton" and "Mirabeau," are being built at the Government yards at Brest and Lorient respectively, but delay occurred in placing the contracts for the other four ships, the "Voltaire," "Diderot," "Condorcet," and "Vergniaud," the Government being undecided as to whether to adopt the turbine system in the new ships or not. The question has now been settled in favour of turbines, and a Ministerial decree has been issued directing the laying down of these four ships in private yards; the "Diderot" and "Condorcet," at the Chantiers de la Loire, and the Chantiers de Penhoët, at St. Nazaire, respectively, while the "Voltaire" will be built at the Chantiers de la Gironde at Bordeaux, and the "Vergniaud" at the Forges et Chantiers de la Méditerranée at La Seyne, near Toulon. The dimensions of the new ships have also been definitely fixed as follows:—Length, 475 feet; beam, 84 feet 3 inches; displacement, 18,350 tons, with a mean draught of 27 feet 9 inches. The engines are to develop 22,500-I.H.P., giving a speed of 19 knots, with four screws; the coal supply will be 2,010 tons, with a radius of action at 10 knots speed of 8,130 miles. The armoured protection will consist of a complete belt of hard steel, with a maximum thickness of 10·8 inches, tapering to 7·8 inches at the extremities; the turrets for the 12-inch guns will be protected by 12-inch armour, those for the 9·4-inch guns by 8·6-inch armour. The armament will consist of four of the new pattern 12-inch guns, and twelve 9·4-inch guns, with sixteen 14-pounders, eight 3-pounders, and two submerged torpedo-tubes. All six ships are to be completed within the four years, and the Ministry of Marine claims that they will be equal in every respect to the similar class of ships now constructing for other foreign Powers.

The *Temps* gives the following information regarding the accident to the submarine "Lutin":—

The enquiry has proved that the catastrophe was due to the presence of a pebble in the inlet valve of one of the ballast compartments, which prevented the valve from closing, thus allowing communication with the outside water, the pressure of which during the dive was thus transmitted to the water ballast, and the inner side of the compartment, which, not being strong enough to resist this pressure, gave way and flooded the vessel.

It might be thought strange that the side of the ballast compartment had not at least equal strength with that of the hull of the vessel; but it must be explained that two systems of water ballast are used in these submarines. In one the water is expelled by means of compressed air, and in the other by a turbine. In the first case the sides of the compartment have to be made strong enough to withstand a greater pressure than that for which the hull is calculated. As the pressure exerted for expelling the water must be a little greater than the outside pressure at any depth, the pressure therefore which the compartment is calculated to withstand is 6 kilos per square centimetre (86 lbs. per square inch), which corresponds to the pressure of the outside water at a depth of 60 metres (196 feet). The resisting strength is, therefore, made greater than that of the hull, which is necessary because the regulation of the admission of the compressed air is a matter of some delicacy, and if the admission was too sudden (the air being compressed to 150 kilos (330 lbs.), a serious accident might take place.

As regards the ballast compartments, which are pumped out by a turbine, the inner sides have hitherto been made thinner and with less resistance, because the water being admitted mechanically, the outside pressure ought not to affect the question. Theoretically this is so, but in practice, as the disaster to the "Lutin" has shown, an accident may alter this. The sides of the ballast compartment which gave way were calculated to stand a pressure of 2 to 2·5 kilos (29 to 35 lbs.) per square inch, and it will be understood that when the dive exceeded a depth of 25 metres (82 feet) this resistance was insufficient, and a disaster must follow. It is believed that the last dive taken by the "Lutin" was not intended to reach this depth, but that it was attained through inability to close the valve and stop the inlet of water.

The commission of enquiry recommend that all ballast compartments should be made of equal strength with the hull. Unfortunately it is only by such sad experience that the necessity for these improvements is discovered. The pebble, the cause of the accident to the "Lutin," is rather larger than a walnut, with flat sides, and shows traces of the pressure brought to bear on it by the valve.

M. Lockroy's Letters on the French Navy in the "Temps"—continued:—

"Several people have written to ask me if the arsenals cannot be depended on to repair vessels damaged in war, and are also unable to do good work in time of peace, would it not be better to do away with them altogether? This would be a great mistake. Besides serving to regulate prices, our arsenals are well able to build the hulls of our vessels, which is of course important work. It is true there are great delays in the building out of all proportion to the time occupied in similar work by foreign countries, so that when completed, many of our ships are already

out of date, a very serious national loss, making the ultimate cost of our ships much greater than it should be. Money badly expended is always money lost, and it is certainly unwise to expend money on building ships which, when completed, are already past their age.

"France formerly had justly the reputation of being the best shipbuilder in the world; England was glad to copy our designs, and the finest vessels in Nelson's fleet were taken at Toulon. Remembering this, we cannot help feeling sad when we compare the work now done in foreign dockyards with that done in our own. While in Germany or England a new ship can be completed in four or even three years, we require five, six, and sometimes eight years for the same purpose. The German battle-ships of the "Braunschweig" class were only four years and the "Deutschland" three and a half years building, and in England the "King Edward VII." class, which are a reply to our "Patrie" class, were in commission, on an average, two years before the "Patrie" had commenced her trials.

Even without M. Pelletan's interference, the "Jéna" was five years on the stocks, the "St. Louis" six and a half years before she was ready, the "Suffren" six years, and the "Henri IV." seven and a half years. The cruisers were longer still: The "Jeanne D'Arc" was seven years and three months building, and the "Dupetit Thouars" eight years, and at one time it was thought the latter would never be finished. A good story is told at Toulon of a working woman who, when asked what trade she was going to bring her son up to, replied in all sincerity: "He will work on the "Dupetit Thouars," as his father did before him."

As regards small craft, the case is no better, the arsenal of Rochefort taking as long in the construction of vessels of 300 tons as the English dockyards take to construct vessels of 16,000 tons.

"What is the cause of all this extraordinary delay? First, dockyard organisation, which remains the same as in the old sailing-ship days, and the frequent alterations made in the plans of vessels building; and secondly, the fact that by all accounts our dockyard workmen do not overwork themselves. The adoption of an 8-hour day does not improve matters. If our machine tools were entirely renewed and brought up-to-date, it might do so. Both England and Germany have been able profitably to introduce the 8-hour day because of the perfection of their tools and machinery; but in imitating them France, as things are, has only added to the evil practices which delay the construction of her vessels.

"Everyone agrees that the present state of things must not continue. Our most distinguished engineers, F. Ferrand and M. Bertin, are of this opinion, and have sounded the alarm. The future of our Navy and perhaps of our country is at stake. A remedy must be found. M. Ferrand suggests several, which for my part I hardly think practicable for financial reasons. When M. Ferrand speaks of specialising the arsenals building only small craft at Rochefort, and concentrating the building of all large ships at Lorient, I fully go with him, and think steps in this direction might be taken at once which would result in considerable economy; but I cannot follow his lead when he proposes a complete revolution in the work of the arsenals. So that in war time the arsenals may be able to repair damaged vessels, which is of course their first duty, and also to expedite shipbuilding, he proposes their sphere of work should be just the opposite to what it has hitherto been. At present, as I said, the arsenals build only the hulls of our vessels; all the organs of the ship, electrical machinery, turrets for guns and gun

mountings are supplied by private firms. Let all this latter work, says M. Ferrand, be done in the arsenals, and let the private firms build the hulls. With this system, he says, shipbuilding will be quicker, and we shall always have trained workmen in the arsenals capable of undertaking any repairs caused by damage of war.

"The solution is a taking one, I confess; but nevertheless, I do not think it practicable. In the first place, it means the doing away with all the building slips in the arsenals, a great loss of money, though we might resign ourselves to this; but the scheme also presupposes the construction and instalment of considerable iron and steel works at each arsenal for the production and manufacture of the steel turrets, gun mountings, electrical appliances, and other machinery. What would be the cost of all this? In the present state of our Budget, with the enormous deficit which presses so heavily upon us, and the additional charges which the new social laws will entail, what Government or Parliament would consent to propose a vote of 80,000,000 or 100,000,000 francs perhaps, which the reforms proposed by M. Ferrand would make necessary? To this difficulty, which is not a light one, must be added another even greater: Where should we find the *personnel* for these new factories? The workmen of our arsenals are, by all accounts, quite unfitted for the purpose; should we have to recruit outside labour and add another 6,000 or 10,000 to the 27,000 workmen we have already? There seems to me, however, a more simple solution possible. As it is the workmen in private firms who are alone capable of carrying out the most difficult and important repairs to our ships, would it not be practicable and economical to pass a law directing that certain categories of workmen employed on ship machinery should be exempt from military service in case of general mobilisation, so that instead of going to fight they would work in their workshops, and thus, without any extra expense, we should find ourselves able to deal with all the requirements of the fleet.

"Japan during her war with Russia did something of this sort; she removed from the active Army the workmen necessary for repairing the fleet, estimated at 30,000 at least. To this Togo in great measure owes his victories; it is an example to be followed.

"If on the day when war breaks out we change the necessary workmen in private firms into workmen for the State, and have the courage at the same time to reduce the number of our dockyard workmen, we shall effect a considerable annual saving, and also be able to provide against all the eventualities of war."—*Le Temps*; *Le Yacht*, and *Le Moniteur de la Flotte*.

ITALY.—The following are the principal recent promotions and appointments: Vice-Admirals—Gualterio to be President of the Superior Council of the Navy; Di Brochetti to Command of Mediterranean Squadron; Grenet to be Commander-in-Chief at Spezia. Rear-Admirals—De Orestis, Mirabello, Annovazzi to Vice-Admirals; Moreno to Command of 2nd Division of Mediterranean Fleet; Cali to Command of the Atlantic Division.—*Gazzetta Officiale*.

Disposition of the Fleet.—The following is the disposition of the Active Fleet on different stations:—

Mediterranean Fleet.

Vice-Admiral Di Brochetti, Commander-in-Chief.

First-class battle-ships—"Regina Margherita" (flag-ship), "Benedetto Brin," "Ammiraglio di St. Bon," "Emanuele Filiberto."

First-class armoured cruisers — "Garibaldi" (flag-ship of Rear-Admiral Moreno), "Francesco Ferruccio."
Torpedo-cruisers—"Coatit," "Agordat."
Special-service vessels—"Vulcano" (factory-ship), "Tevere" (tank-ship).

Reserve and Torpedo Divisions.

Rear-Admiral G. B. Viotti in Command.

Second-class battle-ships—"Dandolo" (flag-ship), "Re Umberto," "Andrea Lauria," "Francesco Morosini."
Torpedo-cruiser—"Caprera."
Despatch-vessel—"Rapido," flying Senior Officer's pennant in Command of Torpedo Flotilla.
Torpedo Flotillas—13 destroyers, 13 sea-going torpedo-boats, 6 first-class torpedo-boats, and 73 second and third-class boats, all in commission with reduced crews.

Atlantic Naval Division.

Rear-Admiral Cali in Command.

Second-class cruisers—"Fieramosca" (flag-ship), "Dogali."

Red Sea and Indian Ocean.

Torpedo-cruiser—"Aretusa."
Despatch-vessel—"Agostino Barbarigo," and five tenders.

China Station.

Armoured cruiser—"Marco Polo."

In Crete and the Bosphorus.

First-class gun-boat—"Governolo."
Despatch-vessel—"Archimede."
Destroyer—"Pelicano."

New Ships.—The following new first-class battle-ships are to be completed as follows:—"Regina Elena," by end of 1906; "Vittorio Emanuele," the autumn of 1907; "Napoli," in the summer of 1907; "Roma" towards the latter part of 1908. The delay in the completion of all these ships is due to the non-delivery of the armour, according to the contract. The "Regina Elena" and "Vittorio Emanuele" were laid down as long ago as 1901, and launched in 1904. These two ships are plated with Terni hard-steel armour, the conning towers being of Terni-Krupp armour; the "Roma" and "Napoli" will have all their armour of Terni-Krupp steel. The "Re Umberto," which last summer completed a thorough repair and overhaul, during her 6 hours' trial trip maintained a speed of 18·4 knots, which was considered very satisfactory, as the ship was launched as long ago as 1887.

The Italian Submarines.—The Italian Navy possesses at this moment three submarines ready for service, the "Delfino," "Glauco," and "Squalo," the two last having been completed last summer and put through their trials in time to permit of their taking part in the manœuvres. Three more are being constructed—the "Narvalo" (nearly finished), and the "Otario," and "Tricheco," both in a fairly advanced stage. The increased vote for 1906 provide for the construction of seven more, but they have not yet been laid down. The "Delfino" is an old submarine, but she was reconstructed about four years ago, and but little of the original boat is left beyond part of the hull,

and in her present condition may be considered as modern; her displacement is 111 tons submerged, 104 tons awash, and 95 tons light; the hull, shaped like a cigar, is 78 feet 6 inches long, with a beam of 10 feet 1 inch. In speed trials, on the surface of water, she made 8¼ knots. The "Glauco" and "Squalo" are almost identical; outwardly they look like torpedo-boats. They are described as "submersible" in distinction to the "Delfino," which is the only "submarine" in the strict sense. Their dimensions are as follows:—Length, 98 feet 4 inches; beam, 13 feet 9 inches; displacement, 150 tons; speed, on trials, 13·5 knots. The "Glauco," by way of experiment, has successfully been submersed to the depth of 90 feet. It is claimed for these submersibles that they have attained a greater speed than either the English or French boats of a similar kind with only half the bulk. They have the dual motor power generally used for submersibles—a petroleum engine for navigating on the surface and an electric motor for running below the surface. The electric power can be recharged by the petroleum engine. The "Otario" and "Tricheco" are being built on the same model. All the submersibles are supplied with the Russo-Laurenti cleptoscope for vision when submerged.

In the recent naval manœuvres in the Ionian Sea, 11th October, 1906, the "Delfino," "Glauco," and "Squalo" were successfully put to the test. They approached by daylight several battle-ships at anchor sufficiently close to be able to discharge their torpedoes before the presence of their cleptoscopes was detected above the water. The same test was made with even more success by night. They also succeeded in crossing from Mestre to Campocavallo, keeping submerged at a depth of thirty to thirty-six feet, and escaping the notice of the torpedo-boats which patrolled the passage.

At the works of the F.I.A.T.-Muggiano, Spezia, a branch of the well known F.I.A.T. automobile manufacturing firm at Turin, the construction of a new submersible has been begun for the Italian Navy. This vessel has been designed by Naval Constructor C. Laurenti, late of the Italian Navy, who is the designer and builder of the Italian submersibles of the "Glauco" type, which have given great satisfaction during the Italian naval manœuvres. The dimensions of the F.I.A.T.-Muggiano submersible are:—Length at the line of flotation, 137·8 feet; beam, 13·3 feet; displacement, when on the surface, 175 tons, when completely submerged, 220 tons. Her speed at the surface, with the internal combustion motors only, will be 15 knots, and fuel will be carried sufficient at this speed for 175 knots. The cruising speed will be ten knots, and the provision of fuel at this speed sufficient for 600 knots. The time required for diving from complete flotation is five minutes. She will carry two tubes for the discharge of 18-inch torpedoes, and two cleptoscopes. Her reserve of flotation when running on the surface will be 120 tons. When in this condition the deck of the boat is more than 3 feet 6 inches above the water, and she can be navigated exactly like an ordinary torpedo-boat. The submersible will be supplied with three sets of engines, designed and made by the F.I.A.T. Company at Turin, and the electric motors have been made on a new principle. She is to be ready for trial at Spezia early next year.—*Marine Rundschau, Italia Militare e Marine*, and other sources.

United States. — *Atlantic Fleet Reorganisation.* — The Secretary of the Navy has signed the General Order for the reorganisation of the Atlantic Fleet. As many of the newer battle-ships designated for service with this fleet are now receiv-

ing their finishing touches in the Navy Yards, it will not be possible to complete the organisation of the fleet as provided for by the General Order until February or March; but so far as possible the plan laid down by the Bureau of Navigation and approved by Rear-Admiral R. D. Evans, Commander-in-Chief of the Atlantic Fleet, is already being followed out. As has been stated, the flag officers who will command the various squadrons of the Atlantic Fleet under the supreme command of Rear-Admiral Evans have not yet finally been chosen, except that it is most probable that Rear-Admiral Thomas, at present in charge of the Naval Training System, will have one of them.

The General Order signed by the Secretary of the Navy provides for the organisation of the Atlantic Fleet into four squadrons, each of which will be under the command of a rear-admiral, and will consist of eight divisions and two torpedo flotillas. The First Squadron, which will consist of two divisions, may be commanded by Rear-Admiral Evans as Commander-in-Chief. The First Division of the First Squadron will consist of the battle-ships "Connecticut" (flag-ship), "Louisiana," "Maine," and "Missouri," and the Second Division of the First Squadron will consist of the battle-ships "Georgia," "New Jersey," "Rhode Island," and "Virginia." The Second Squadron will have the Third and Fourth Divisions. The Third Division will consist of the battle-ships "Alabama," "Illinois," "Kearsarge," and "Kentucky," and the Fourth Division the battle-ships "Ohio," "Indiana," and "Iowa" for the present, and the "Minnesota" as soon as that vessel is completed and ready for active service.

The Third Squadron of the Atlantic Fleet will have the Fifth and Sixth Divisions. The Fifth Division will consist of the first-class armoured cruisers "Tennessee," "Washington," and "St. Louis," and another armoured cruiser as soon as completed, and the Sixth Division of the protected cruisers "Columbia," "Des Moines," "Cleveland," and "Tacoma."

In the Fourth Squadron there will be the Seventh Division, consisting of the small cruisers "Dixie," "Marietta," "Nashville," and "Castine"; the Eighth Division consisting of the small cruisers "Prairie," "Dubuque," "Paducah," "Scorpion," and the second-class battle-ship "Texas" and armoured cruiser "Brooklyn" in reserve; the Second Torpedo Flotilla, consisting of the "Hopkins," "Hull," "McDonough," "Whipple," "Truxtun," and "Worden"; and the Third Torpedo Flotilla, consisting of the "Wilkes," "Blakeley," "De Long," "Stringham," and "Stockton." The Order provides that the Seventh and Eighth Divisions will be held in reserve when their services are no longer required for police and patrol duty.

It is the intention to maintain a strength of sixteen battle-ships for the Atlantic Fleet, and as fast as new vessels of this class become available the older battle-ships will be replaced by new ones, and a reserve squadron of armoured vessels will be formed. This is a matter which was dealt with very fully by Rear-Admiral George A. Converse, Chief of the Bureau of Navigation, in his annual report made public some weeks ago. —*U.S. Army and Navy Journal.*

MILITARY NOTES.

HOME.—The following are the principal appointments which have been made :—

Lieut.-General—Sir Bindon Blood, K.C.B., to be General.

Major-Generals—H. Mansfield, C.B., I.A., to be Inspector-General of Supply and Transport. A. G. Creagh, C.B., to Command the Troops in Mauritius. T. E. Stephenson, C.B., to Command the 6th Division. G. I. R. Richardson, C.B., C.S.I., C.I.E., I.A,, to be Lieut.-General. D. A. Scott, C.V.O., C.B., D.S.O., to be a Commander of Coast Defences.

Colonels—F. H. Kelly to be a Colonel on the Staff. G. F. C. Mackenzie, C.B., to be an A.A.G. C. G. M. Tasken, C.B., I.A., to be a Colonel on the Staff. R. G. Broadwood, C.B., A.D.C., from Commanding Orange River Colony District, to Command the Troops in South China, with promotion to the rank of Major-General. R. F. Johnson, C.M.G., from h.p., to be Brigadier-General to Command Coast Defences, with the temporary rank of Brigadier-General. E. S. Bulfin, The Royal Welsh Fusiliers, to be an A.A. and Q.M.G. B. R. Mitford, D.S.O., from h.p., to be a Brigadier-General to Command an Infantry Brigade. H. N. Bunbury, C.B., Brigadier-General in Charge of Administration at Gibraltar, to be Major-General. G. Barker, C.B., Inspector of Royal Engineers, to be Major-General. Sir J. G. Maxwell, K.C.B., C.V.O., C.M.G., D.S.O., Staff Officer in the Inspector-General to the Forces, to be Major-General. H. E. Belfield, C.B., D.S.O., Brigadier-General Commanding 4th Infantry Brigade, to be Major-General. B. T. Mahon, C.B., D.S.O., a Brigade Commander in India, to be Major-General. Sir J. Willcocks, K.C.M.G., D.S.O., a Brigade Commander in India, to be Major-General. T. Perrott, C.B., Brigade-General, Commanding Coast Defences, Scotland, to be Major-General. E. A. H. Alderson, C.B., A.D.C., Brigadier-General, Commanding 2nd Infantry Brigade, to be Major-General. J. Spens, C.B., A.D.C., a Brigade Commander in India, to be Major-General. H. E. Stanton, D.S.O., R.A., to be an A.D.C. to the King. G. C. Fuller, Staff-Paymaster, to be Chief Paymaster.

FRANCE.—*Rôle of Artillery in the Russo-Japanese War.*—In his report on the *Budget Général de l'Exercise, 1907,* M. Messiney writes thus regarding artillery action in the late war in the Far East:—

Although the events of the war in Manchuria are not yet known in all their details, the features of most of the battles demonstrate that the importance of this arm has considerably increased. The actors in the struggle were all impressed by the effects of modern artillery. "One soon gets accustomed to infantry fire," writes Captain Soloviev, in his *Impressions of a Company Commander*; "but artillery fire produces a very strong impression. On those unaccustomed to war, common shell produces the greatest impression; on those inured to war, shrapnel. Young soldiers in the skirmishing line bury their faces in the ground at the bursting of the projectile. It is absolutely impossible to cross an exposed zone under artillery fire, not only in column, but even in deployed formation." The proportion of artillery with the Russian Army was considerably

less than that with the Japanese.[1] The Russian artillery, too, had constantly the worst of it in the first actions, and, not taking into account the disproportion of the total forces engaged, it is to this fact that the really decisive results obtained by the Japanese, in their first encounters, must to a great extent be attributed.

The Yalu.

At the Yalu (1st May, 1904), Kuroki's Japanese deployed 72 field guns and 12 large calibre guns, against General Sassulitch's 24 guns.[2] After an artillery fire which lasted until the evening, General Kuroki gave the order for the attack. At 9 o'clock the Japanese were masters of the first Russian line; the fight had lasted for less than 2 hours and had cost them about 600 men. "It is to the excellence of the artillery preparation, and to the close co-operation of the two arms during the advance that the small losses of the Japanese, in spite of the density of their attack formation, must be attributed," says Major Meunier, in his *Russo-Japanese War*. Herr von Gottberg, the correspondent of the *Lokal Anzeiger*, and an eye-witness, says, with regard to this subject:—"The frontal attack was almost exclusively supported by artillery fire. They were opposed by 4,000 rifles, which fired more than 400,000 cartridges in the half hour—figures hardly proportionate to the loss of 600 men. The cause of this extraordinary inefficacy of the infantry fire was apparent to every spectator who observed the accurate and truly infernal fire of the Japanese artillery."

Nanchan.

Numerous episodes show that the most energetically conducted frontal attack fails if the defender is not shaken by artillery fire. At the battle of Nanchan (25th May, 1904), which took place after the landing of the IInd Japanese Army, and which resulted in the isolation of Port Arthur, the attack of the 4th Japanese Division opened at 6 a.m. with a heavy fire of the divisional artillery, whilst 4 gun-boats were lying in the bay of Kin-chau supporting the artillery with their broadsides, brought to bear on the Russian position in reverse. At 9 o'clock General Oku, wrongly thinking the preparation sufficient, advanced his three divisions. This attack completely miscarried; the 4th Division stopped at 400 yards, found itself in a most critical position, because the low tide had obliged the gun-boats to temporarily draw off. At 3 o'clock the return of the latter permitted a fresh advance to be made, but the artillery preparation remained insufficient, and at 5 o'clock the Japanese offensive was held along the entire line. It was only at the price of enormous losses (51 officers and 713 men killed and 100 officers and 3,460 men wounded), and thanks to a turning movement of the 4th Division, marching through the water by the Bay of Kinchau, and taking advantage of the dead angles to reach the left flank, which determined the retreat of the Russians, who were anxious about their communications.

Wafangkou.

At Wafangkou (14th-15th June, 1904) the Ist Siberian Corps had 29 battalions and 10 batteries (80 guns); the Japanese had 40,000 men and

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[1] This proportion was, in the theatre of operations, approximately 3 guns per 1,000 men with the Russians, and 4 guns per 1,000 men with the Japanese.

[2] In spite of their numerical inferiority, the Russians kept 3 batteries out of the 6 they brought into action in reserve.

216 guns. The superiority of the latter in artillery was thus considerable. On the morning of the 15th the Russian batteries, as soon as they opened fire, were opposed by the Japanese artillery, which fired with remarkable accuracy. The Russian artillery, attempting to change position in view of the enemy, the Japanese artillery concentrated its fire successively on each of the Russian batteries. In 20 minutes the first battery was completely destroyed, and the others suffered the same fate in succession. From that moment the infantry fight and the retreat became extremely deadly for the Russians, who lost 130 officers and 3,500 men, whilst the Japanese report a loss of 51 officers and 1,160 men. This disproportion is attributed by all eye-witnesses to the numerical superiority of the Japanese artillery, and to its judicious tactical employment.

From Liao-Yang the effective of the Russian Army commenced to considerably surpass that of the Japanese; in spite, too, of their small proportion of artillery, the Russians had a total of more guns than the latter. Nevertheless, as a rule, the Japanese artillery were superior to the Russian, because the latter nearly always kept a portion of its batteries in reserve, instead of engaging them all from the commencement, as the Japanese did, and also because the latter, as Captain Soloviev says: "Accustomed for many years to the service of their guns, used them more skilfully than the Russian artillerymen, who were introduced to their new gun during the route, and were instructed in their management in the railway carriages."

Liao-Yang.

At Liao-Yang (1st September, 1904) the 37th Russian Regiment was attacked in its position by the Japanese. The latter came so close to the Russian trenches that after the action 30 dead bodies of Japanese were removed at 15 yards distance from them, and 580 from between 100 and 150 yards. The attack, nevertheless, failed because the defenders, not being subjected to artillery fire, kept cool. The losses, too, of the Russian regiment were only 6 officers and 300 men, 54 of whom were killed.

In short, the successes of the Japanese were more or less decisive according as their artillery more or less rapidly dominated the enemy's. When they were able to attain this result, either from their numerical superiority, as at the commencement of the war, or because they were better handled, the action was decisive, as at the Yalu and Wafangkou. When they were unable to attain it, their attacks miscarried, or only succeeded at the cost of enormous sacrifice of life, as at Nanshan and in the numerous unfruitful attacks attempted at Liao-Yang, the Sha-ho, and at Mukden. According to all eye-witnesses, the gun was one of the chief factors in the victory of the children of the Rising Sun.

Professional Instruction in Barracks.—In consequence of reports from corps commanders acknowledging the favourable results obtained from professional instruction in barracks, the War Minister has notified, by a circular of the 28th July last, the basis on which that instruction should be organised.

Starting from the principle that this instruction in military matters should never be permitted to become wearisome, the War Minister is of opinion that it cannot be given to recruits during the first six months of their arrival in camp. Further, as there can be no question of organising a thorough professional instruction, or a manual instruction necessitating the establishment of workshops and of special plant, an endeavour should

merely be made to inculcate in the men ideas which are indispensable to them for the intelligent exercise of their profession, and which they cannot acquire elsewhere. It only concerns, then, those men who have already exercised a manual profession before their entry into the Army, and should be given in the form of visits, conversations, or lectures, with practical schemes and demonstrations. This instruction will be adapted to each group of similar professions, viz., agricultural, industrial, and commercial. In each of these three categories, embracing the different professions, will be formed, according to the strength and composition of the contingents, and according to the number of the civilian and military instructors available, groups of professions with points of similarity, and for which the garrison resources will permit the giving of collective and profitable instruction. The War Minister recalls the fact that since 1902 agricultural lectures have been given to the men by departmental professors of agriculture, and that directors, professors, and inspectors of practical industrial and commercial schools, and of professional, national, and municipal schools, have been invited to place all the means at their disposal for the work of professional instruction.

He, consequently, invites corps commanders to come to an understanding with the officials and professors, and, if necessary, with the State representatives of departments and Communes, and, eventually, and on their own responsibility, with the local societies for professional instruction. The effective participation of officials and professors of commerce and industry will be always confined to a few lectures, their chief *rôle* being to give their advice and private information to the officers supervising the professional instruction in regiments. The lectures, visits, etc., will be purely optional, and will take place at hours other than those set aside for regular military work.

Corps Commanders will commence by drawing up, for the commencement of next year, a programme of professional instruction and a series of visits to public or private commercial, industrial, and agricultural establishments in the garrison or its immediate neighbourhood. These programmes should have been communicated to the War Minister on the 1st October last in order to elaborate a general scheme to put this instruction into practice as soon as possible.

Independently of the collective professional instruction thus organised in regiments, commanding officers will authorise soldiers, to as great an extent as possible, to individually follow technical or practical courses in existing establishments.

The War Minister concludes by urging the military authorities to utilise all the resources at their disposal, to cause this instruction to be given by following the general lines indicated; in this manner, he says, they will help to keep men in touch with and perfect them in their former professions, which will assist in decreasing the too large number of ne'er-do-wells, and the stay in the regiment, short as it may be, will exercise a happy and profitable influence on the whole of their lives as civilians.—*Bulletin de la Presse et de la Bibliographie Militaires.*

GERMANY.—*Recruiting Statistics for 1905.*—The number of young men who attained the age for military service amounted to 500,047. By adding those put back in 1904 (320,949), in 1903 (246,719), and in the

previous classes (38,101), the total of the recruiting resources amounted to 1,105,816 men. The classification was made as follows :—

		Men.
Unfit for service ...	... ...	34,172
Debarred from service ...	... ...	976
Put back, emigrants, in excess...	... ...	626,515
Enrolled in the Territorial Army	Combatants (a)	206,876
	Non-combatants (b)	3,457
Enrolled in the Navy ...	... ...	8,757
Assigned to the Recruiting Reserve	Navy	1,647
	Army	81,417
Attached to 1st Levy of Landsturm ...	... ...	111,187
Enlisted as Volunteers	in the Army (c)	29,318
	in the Navy...	1,494
Total		1,105,816

The number of young men who enlisted in the Army before reaching the military age, and including one-year volunteers, amounted to 22,229. By adding this last number to those mentioned under the figures (*a*), (*b*), and (*c*), a total contingent of 261,880 men will be found, enrolled in 1905, and showing an increase of 1,124 men over the contingent of 1904.

Military Technical Academy.—The object of this Academy, formed in 1903, is to obtain for officers of all branches of the Service the necessary information regarding armament and the duties of engineers and lines of communication troops. The new regulation of the 28th April, 1906, lays down, in addition, that this establishment should train officers of foot artillery, corps of engineers, and pioneers, and of lines of communication troops. The mixed School of Artillery and Engineers has consequently been incorporated with the Military Technical Academy. The latter consists of three great divisions: the first for instruction regarding arms; the second for engineers; and the third for communications.

The 1st Division consists of a three years' course of study, plus one inferior course of foot artillery, obligatory for all officers of that arm, and one higher course in the same subject to complete the special instruction acquired in the inferior course. During the first year 50 officers may be admitted, 12 of whom belong to the field and 12 to the foot artillery, who have gone through the above-mentioned inferior course; the other vacancies remain available for officers of other branches of the Service. The second and third years' courses each consist of about 25 officers; the last year is sub-divided into one construction and one ballistic section.

The 2nd Division also consists of a three years' course of study, preceded by a pioneer course, obligatory for officers of that branch of the Service, and to which may be admitted the candidates for the 2nd Division belonging to other branches of the Service, provided they have served with a pioneer battalion for one year.[1] The most capable officers of the pioneers' course then pass into the first year of the 2nd Division; then, after a period with a regiment or in a fortress, may return to the Academy and follow the courses of the second and third years.

The 3rd Division is also divided into a three years' course of study, which should, as far as possible, be followed by all officers of lines of

[1] Infantry officers are detached to pioneer battalions for one year, and *vice-versâ*.

communication troops. The first year 20 officers may attend the course, and the second and third years 15, including officers of other branches of the Service. The total number of officers of the two last years of the three divisions may not exceed 100.

The Military Technical Academy is under the Inspector-General for Military Instruction, and is placed under the direct orders of a general officer, who is president, at the same time, of the Special Commission of Studies, which consists of seven military members and some learned savants. As regards the programme of studies, the regulation says that in the two foot artillery courses and that of the pioneers, and as well as that in the first year for engineers, the instruction should be practical and be immediately applied. For the rest, the Academy should partake of the nature of a University, and, like it, should give officers a scientific education based on the mathematical and natural sciences. The regulation also lays down that inspectors-general of foot artillery and of the engineer and pioneer corps, of field artillery and of lines of communication troops should exercise a determining influence on the training and the selection of officers of their arm. This influence extends to changes to be introduced into the programme of instruction, to the fixing of the plan of study, to proposals regarding the nomination of directors and assistants, as well as to the choice of professors and scholars.—*Bulletin de la Presse et de la Bibliographie Militaires.*

JAPAN.—*Development of the Military Forces of Japan.*—The *Ruskii Invalid* recently published a letter from a colonel of the Russian General Staff, who served throughout the recent war, and who is at present in Manchuria, on the development of the Japanese military forces during the last war and since the conclusion of peace.

At the commencement of the Russo-Japanese war the Japanese Army was composed of 13 divisions of field troops (1 being the Guards), each consisting of 4 infantry regiments (12 battalions), 1 cavalry regiment (3 squadrons), 1 artillery regiment of 6 batteries (36 guns), 1 engineer and 1 transport battalion. In addition, the Army included 2 independent cavalry brigades of 8 squadrons each, and 2 artillery brigades of 3 regiments of 6 batteries each.

As reserves, there should have been normally as many reserve as Regular battalions, viz., 156; but just at first there were only formed 78 reserve battalions, grouped into 13 reserve brigades of 6 battalions each, and having 1 reserve squadron and battery. Consequently on the outbreak of the war Japan could dispose of 234 battalions, 56 squadrons, and 684 guns, about a third of the latter being mountain artillery. These numbers were known in April, 1904, to the Russian General Staff, and their correctness was confirmed in the course of the campaign, but the Russian Headquarters did not care to admit it. These forces mobilised very slowly. At the commencement of the war 7 divisions only were mobilised. At the battle of Liao-Yang 10 only were on the field of battle, and it was only at the time of the battle of Mukden that the 13 field divisions were all of them in Manchuria.

In a general way the Japanese endeavour less to increase the number of their units as to maintain all existing units up to strength. They were able to deceive the Russian command by their vigorous conduct of the war and by the energy of their offensive. It was only at the time of the battle of Mukden that they had been able to considerably increase the number of their units and to place in line, in addition to their 13

field divisions, 15 reserve brigades, making a total of 276 infantry battalions, 70 squadrons, 900 guns, and about 200 machine guns. Intelligence from the most reliable sources declare that the Japanese were less numerous than the Russians at Mukden.

After the battle of Mukden the considerable increase in the effective of the Russian Army forced the Japanese to raise further fresh units. They were able to raise, thanks to the tranquility they enjoyed, 3 new field divisions, which were numbered 13, 14, and 18, and 3 new reserve brigades, numbered 16, 17, and 18, of 8 battalions each. At the same time they increased their artillery by using, especially, the *matériel* taken from the Russians. At the time of the conclusion of peace they had 16 field divisions, including the Guards, and 19 reserve brigades, including 1 of the Guards, making a total of 344 infantry battalions. At that time the Japanese Army could not have had more than 400,000 combatants present under arms. To achieve this result they had to make the greatest efforts, and to call to the colours classes which had been discharged for a considerable time. Finally, in October, 1905, a new division (the 16th) was formed, which made an increase of 15,000 or 20,000 combatants.

The war concluded and demobilisation accomplished, the Japanese only left 4 divisions on the continent, viz., the 13th and 14th in Korea, and the 15th and 16th in Manchuria. All the remainder returned to Japan to the peace garrisons, and the reserve units were disbanded.

The following are Japanese projects for the future :—

Besides the Guards, the 12 divisions existing before the war and the 4 divisions formed during it (altogether 17 divisions, 1 to 16 and the Guards), 4 others will be raised and numbered from 17 to 20. The 17th is, apparently, already actually organised. Further, there is a special kind of division at Formosa, which was replaced during the war by reserve units, and brought over to General Nogi's Army, but which is now occupying its former garrisons.

The Japanese Government proposes to group 20 divisions, when they have all been organised, into 10 army corps of 2 divisions each, the Guards continuing to form a separate division. Each infantry division will continue to consist of 2 brigades of 2 infantry regiments of 3 battalions each. The division will, in addition, include :—

1 cavalry regiment of 3 squadrons.
1 field artillery regiment of 6 batteries (36 guns).
1 engineer battalion of 3 companies.
1 transport battalion of 2 companies.
1 bridging park.

A detachment of 6 machine guns will be given to every infantry regiment.

The Guards Divisions include a brigade of Guards cavalry of 8 squadrons, a Guards artillery brigade of 3 regiments, and, as in the other divisions, 1 pioneer and 1 transport battalion.

For the Manchurian railway service, a special regiment of railway troops was raised during the war which was kept in Manchuria on a peace footing. In war they will expand into 3 regiments. Further, to the 1st Division (Tokio) is attached an independent cavalry brigade, and to the 2nd Division (Sendai) is attached an independent artillery brigade. At the present time the divisions which have returned to Japan each consist of 12,000 men, in round numbers, at a peace effective; the 13th, 14th, 15th, and 16th Divisions, kept on the continent, each have an effective of about 20,000 men. Thus the present peace strength of the

Japanese Army (4 divisions having still to be formed) is from 220,000 to 250,000 men.

In war time, when once completely mobilised, the division will have an effective of 22,000 men. Each division, in addition to its peace units, will receive: a medical detachment of 6 field hospitals, 1 pontoon bridge equipage, 1 telegraph detachment, 4 artillery ammunition sections, 1 infantry ammunition section, 4 administrative convoy sections, 1 horse depôt, a provost marshal section. In addition, each division will form a reserve brigade of from 8 to 12 battalions.

The war effective of the Japanese Army will thus amount to the following: —

	Men.
Guards field division and reserve brigade	40,000
10 army corps	480,000
20 reserve brigades, of 8 battalions each	160,000
53 reserve regiments, 2nd line...	150,000
20 reserve artillery regiments	12,000
3 railway regiments	7,500
Formosa Division	18,000
Territorial Army	40,000
25 fortress artillery battalions	10,750
Departmental and lines of communication troops	120,000
Total	1,038,250

To these must be added from 100,000 to 110,000 coolies, so that the general effective would amount to 1,150,000 men.—*La France Militaire.*

NETHERLANDS.—*Reorganisation of the Infantry and Fortress Artillery Reserve Cadre.*—The object of the reserve cadre is to complete and reinforce the *personnel* of the lower non-commissioned ranks on mobilisation. In consequence of the changes introduced by a Royal decree of the 8th May last, the working of this institution, as regards infantry and fortress artillery, rests on the following principal orders: The reserve cadre consists of two categories of volunteers. The first is composed of candidate ensigns, corporals, sergeants, and ensigns (adjutant-non-commissioned officers) of reserve. The candidates must be at least 17 years of age, and possess a certain degree of general instruction and physical training. They must also previously give proof of military ability and enlist before being entered on the lists for drawing lots. In future young men of the military age will be admitted to the cadre up to the 1st March, the month fixed for enrolment into the dismounted branches of the Service. The 2nd Category consists, on their application, of old non-commissioned officers who have been discharged for three years. As regards the volunteers of the 1st Category, the period of engagement is fixed as follows: 15 years (the period of Militia service) for those who are called out to form part of the contingent; 12 years for those who have no military obligations to fulfil. In both cases the men in question serve for 8 years at least in the Regular Army, and the remainder in the landwehr.

These volunteers are obliged :—

1. To complete 8 months Regular service during the first 3, and exceptionally during the first 4, years of their engagement, which, on their application, need not commence until they have completed the 22nd year of their age. This period of first training is reduced to 7 months for youths who, from the 20th July, put in 60 days' continuous service during

the first year, and 75 days in each of the second and third (exceptionally third and fourth) years of their engagement.

2. To take part, until their appointment of sergeant, in local drills, at the rate of 4 hours a week, during 6 months of the year, as a maximum.

3. To serve for 6 weeks during the 18 months following their appointment to the rank of sergeant and ensign. This obligation may run concurrently with No. 1.

4. To put in 6 weeks' Regular service every 2 years, or 3 weeks every year, from the year when they completed the period of first training to the time of their transfer to the landwehr.

Volunteers called upon to form part of the contingent, who have not obtained the rank of ensign on the expiration of their period of 8 or 7 months, prolonged on their application to 12 months, go back to their position as Militiamen. The other volunteers who, having benefited by the reduction of the period of service to 7 months, have not been promoted to the rank of corporal or sergeant, are called out again the following year for a period of 30 days.

Volunteers of the 2nd Category enlist for 6 years. They may be called out for 1 month during each of the first, third, and fifth years of their engagement; non-commissioned officers may be used as instructors for local military preparatory instruction courses. On the expiration of the first engagement, non-commissioned officers of the 2nd Category are permitted to re-engage for a maximum period of 6 years up to the age of 40. Volunteers of the reserve cadre serving with the colours receive the pay and allowances given to soldiers of the Regular Army of the same rank as themselves. They are also entitled to the following annual bounties :—

	£	s.
Corporal of the 2nd Category	2	10
Sergeants ,, ,, ...	4	4
Sergeants fit to be appointed ensigns	5	0
Ensigns	8	9

These last receive, in addition, on appointment a first equipment outlay of £16 18s.—*Bulletin de la Presse et de la Bibliographie Militaires.*

Recruitment of the Landwehr Cadres.—The lower cadre of the landwehr is fed by :—

1. Militia non-commissioned officers who have completed their military obligations in the Regular Army.

2. Volunteers of the reserve cadre who have completed their period of service in the reserve of the Regular Army.

3. Non-commissioned officers pensioned after 15 years' service, in so far, always, that they are not attached to units of the Regular Army. They may be called out either every 2 years for 6 weeks, or for 3 weeks every year, as they may choose, or be appointed instructors to local military preparatory instruction courses.

4. In default by young men between 21 and 30 years of age, who are not compelled to any military obligations, and by old soldiers of at least 36 years of age admitted at once as volunteers into the landwehr.

According to a Royal decree of the 8th May last, which dealt with changes in the recruiting of men of the 3rd and 4th Categories, candidates having left the Army less than 3 years ago may be admitted, as volunteers, either with their former or with a lower rank. The period of engagement is for 7 years, that fixed for service in the landwehr. In a general way volunteers are obliged to take part in local courses as well as in

landwehr exercises. Old soldiers, having left the Army for more than 3 years, may be compelled to take part in a first exercise of a maximum duration of 2 months.

In order to be promoted to a higher rank, volunteers of the landwehr must possess the knowledge required from candidates for the same rank in the Regular Army. In order to permit them to acquire that knowledge, they may be authorised to serve with Regular troops for a certain time not exceeding 3 months in the same year. During their presence under arms they are entitled to the pay and allowances of soldiers of the rank and arm in the Regular Army. Non-commissioned officers admitted as volunteers receive an engagement bounty fixed at the following rates :—

Adjutant non-commissioned officer, £12 12s.; sergeant-major, £8 8s.; quartermaster-sergeant and sergeant, £6 6s.

Pensioned adjutants and non-commissioned officers of administration, carrying out, in addition to their ordinary duties, those of instructors at local courses, similar to all volunteer non-commissioned officers, receive an annual allowance as follows :—

Adjutant non-commissioned officer, £46; sergeant-major, £12 12s.; quartermaster-sergeant, £6 6s.; sergeant, £4 4s.

Those who are employed as instructors receive in addition from 6d. to 10d. per hour of duty. Further, adjutant non-commissioned officers are entitled to a first equipment outlay of £8 8s. and an annual subsistence allowance of £2 2s. On the expiration of their first engagement, volunteers may re-engage, without bounty, for periods of from 2 to 7 years up to the age of 60 years.—*Bulletin de la Presse et de la Bibliographie Militaires.*

PORTUGAL.—*New Scheme of Promotion for Under Officers.*—The promotion of under officers and sergeants is carried out through commanders of units, that of first sergeants and sergeant-adjutants through the War Minister; in engineer regiments and in the medical department first sergeants are also promoted by the commander of the unit or department.

1. *Under Officers.*—The rank of lance-corporal is filled from the ranks and that of corporal from the lance-corporals, both nominated on the proposal of the company, squadron, or battery commander. Only men of exemplary character, who have served at least 60 days in the Regular Army, may be appointed lance-corporals. Lance-corporals who have conducted themselves well, have served at least 60 days in the Regular Army in that rank, and who have successfully passed through the course of instruction for under officers, can be promoted to the latter rank.

2. *Sergeants.*—Sergeants will be selected, according to their capacity, from the under officers. The rank of first sergeant is filled from sergeants of the units as a result of a competition laid down by the War Minister, the results of which are reported, and according to them the appointments as first sergeants are carried out with regard to existing vacancies. Candidates for the rank of sergeant and first sergeant must have an irreproachable character, have served at least for 60 days as under officers, as well as 90 days as sergeants in the Regular Army, have already belonged to the unit in question for 60 days before the commencement of the competition, and have successfully gone through the sergeants' course. The conditions for the competition and the time the latter will take place, are made known 20 days before its commencement. The Board of Examination consists of a major, as president, 2 captains, 1 subaltern officer, and 1 secretary (a sergeant). The candidates will be practically examined, both

orally and by writing, and must drill a detachment, deliver a lecture on a given subject, and solve three or four problems, taken from different regulations, in at most four hours. Candidates who belong to the administration companies take part in a competition held in a regiment quartered in Lisbon. The Board of Examination for independent artillery detachments, engineer and medical companies are somewhat different in their composition to the Board previously mentioned above.

3. *Sergeant-Adjutants.*—These are promoted, according to seniority in each branch of the Service, from the first sergeants or from the cadets or cadet-sergeants, who have gone successfully through a course at the Central Sergeants' School, or through the first year's course at the Army School, and have passed a practical examination. They must, in addition, have done at least 3 months' Regular service as first sergeants, be of exemplary character, and have shown themselves fit for promotion.

During mobilisation or in the course of a campaign the existing vacancies in the different under officers' ranks will be filled by reservists, who, before their discharge from the Army, shewed the requisite attributes of under officers, or have displayed them since. Should there not be a sufficient number of these men, men from the ranks, who had the required professional qualifications in peace time, will be promoted lance-corporals, and, if necessary, under officers, if they can read, write, and keep accounts, if recommended for promotion by their company, squadron, and battery commanders. The appointment of under officers and sergeants to the rank of first sergeant is made by means of a competitive examination, and consists of a practical and a written part, and the Board is composed of 1 staff officer, 1 captain, and 1 secretary (a sergeant).

All men who consider themselves fit to perform the duties of under officers in the event of war, should report themselves, two days before their discharge to the reserve, to their company, squadron, or battery commanders in order to be examined as to their fitness for the position. In the event of a mobilisation, they will be immediately ordered to take up those positions for which they have passed.—*Militär Wochenblatt* and *Ordem do Exercito.*

RUSSIA.—*New Organisation of Machine Gun Units.*—The reorganisation of machine gun units was decided upon by the War Council on the 25th October last, and ordered to take place by the Tsar on the 23rd November following.

At the time of the introduction of this new organisation, the Russian Army had 112 machine gun companies of 8 guns each, or a total of 896 machine guns, which were distributed as follows :—

33 Infantry divisions... ...	each with 1 machine gun company = 36 companies.
3 Reserve brigades	
8 Infantry divisions... ...	each with 2 machine gun companies = 76 companies.
9 Rifle divisions	
18 Rifle brigades	
3 Reserve brigades	

Eleven infantry divisions and most of the reserve brigades had no machine gun companies.

According to the recently issued regulation, the machine gun companies will be changed into machine gun commandos; nothing has been given out as to their number, composition, and distribution. The new organisation will be an experimental one; the fixed establishment will be regarded as a provisional one. The machine gun commandos will im-

mediately be joined to those infantry, rifle, and reserve regiments or battalions to which they are assigned. The commanders will be responsible for the training and administration of the commandos to the same degree as they are for the other portions of their regiments, etc. In addition, the commandos in every unit will be also under a staff officer, who will have the same authority with regard to them as that possessed by a not independent battalion commander.

The unit commander selects the commander of a machine gun commando from amongst the number of the staff captains and lieutenants. Sub-lieutenants are excluded from selection. The commando commander receives 180 roubles (about £16 5s.) yearly for table money. The non-commissioned officers and men of the commando have the same status as those of the unit to which they are attached. The men should, if possible, not be illiterate, have good eyesight, and must thoroughly fulfil all the conditions required of a private soldier. The increase on mobilisation, too, is carried out through the regiment or independent battalion. For that purpose the units in question must train at least 1 non-commissioned officer and 20 privates in the machine gun during the year.

The remount will be carried out according to regulations already existing for the increase of the transport. Horses will be specially favoured who are likely to make good draught animals. This condition is due to the fact that it has been decided that provisionally, for the greater portion of the commandos, the transport of the machine guns will be carried out by draught animals and by porters. It has been decided to house the commandos in barracks. In addition to the training ordered by the regimental commanders, the commandos will have to attend shooting practice at the artillery ranges.—*Militär-Wochenblatt.*

CORRESPONDENCE.

RE THEORIES AS TO THE BEST POSITION FOR Q.F. SHIELDED ARTILLERY.

To the Editor of the JOURNAL OF THE ROYAL UNITED SERVICE INSTITUTION.

SIR,—I write to support unhesitatingly the able ideas enunciated by Major J. F. Cadell, R.F.A., *p.s.c.*, in the December No. of the JOURNAL. I do so as an infantry officer. The Franco-German war was the apotheosis of modern artillery tactics in battle as practised by the Germans because the Germans had learned in the school of Napoleonic thought. In the Russo-Japanese war the Japanese, who had mostly adopted German ideas, practised the Napoleonic thought as far as they could learn them second-hand from the Germans. In both wars those who won were undoubtedly influenced by this thought; but in the future, success will be with that Army which has learned how to combine the working of all arms together in battle—the Army which learns the Napoleonic lesson of the just employment of the three arms in such a manner that they shall mutually support and defend each other to as great an extent as possible.

Now, as infantrymen, what do we expect from our artillery?

We expect that our artillery shall not leave us to be exposed alone to the attacks of the enemy's cavalry and infantry.

That our artillery shall not leave us to be exposed alone to attack from the enemy's artillery and infantry. That our artillery shall not leave us to be exposed alone to attack from the enemy's cavalry and artillery.

Infantry would never dream of attacking alone the enemy's artillery in position with any chance of success, even though that artillery be unprotected by infantry or cavalry, for it was clearly demonstrated in 1870 that a line of artillery was invulnerable in its front. Napoleon, however, had settled that question years ago. He said: "There is no infantry, however brave, which can, without artillery support, march with impunity 1,000 or 1,200 yards against cannon well served; before it could accomplish two-thirds of the distance those men would be killed, wounded or dispersed."

But we infantry can and will attack any object as long as we are supported by the sister arms of the Service. When in the attack our advance is suddenly checked by any hostile troops, whose resistance we cannot overcome, it is from our artillery fire switched on to that hostile force that we expect the relief necessary to enable us to continue our attack.

Whenever our artillery sees our infantry in the attack repulsed or breaking back because of a sudden stroke of greater energy from some body of hostile troops, we expect our artillery, without being asked for it, to immediately switch on its fire on to that body of hostile troops, so that we may, under the relief afforded by our artillery fire, rally again, go forward again, or anyhow hold our ground until such time as we may be able to resume our advance.

In battle, we of the infantry feel greatest confidence when we know that our artillery leaders, or better still, our artillery leaders, our cavalry leaders, and our Commander-in-Chief have their eyes glued on our infantry efforts, so that we may feel instinctively that whilst we are attacking, they are watching for all and every opportunity to intervene in our favour as fast as these opportunities occur. For these opportunities are hardly born when they disappear again.

How can this be done if our artillery, so important a factor in battle, cannot see and follow with their eyes the efforts of their infantry comrades? How can this object be attained if the idea of indirect fire is overdone?

That is a job for the gunners to solve; all that I can say is that we want the gunners to be in our battle, and at our elbows, figuratively speaking.

That some batteries should be employed in indirect fire is no harm, for unless their position has been located by the enemy, these batteries, being masked, can at any time be safely withdrawn and disposed of or concentrated on to another part of the field, and thus a commander may profit by what Napoleon meant when he said that the leader who knew how to suddenly bring together a great number of guns on to a certain point was sure to win. In Napoleon's days that *rôle* was played by his reserve artillery, when he had decided on the point where he intended to drive in his decisive attack. Nowadays that *rôle* may yet be played by the batteries that are still disposable, although engaged in indirect fire, so long as they have not been located by the enemy.

But if the doctrine of indirect fire be cultivated too far, we shall fall into the error the French fell into before 1870, with the doctrine they adopted with their new rifle. The French, having a very superior rifle, adopted the unfortunate doctrine of using that rifle to hold on to

positions. Their generals were continually reporting that their troops had succeeded in holding the magnificent positions allotted to them, and without much loss. They held much the same doctrine enunciated by Colonel Novikof, who is a strong advocate for hidden positions. The Germans had a far inferior rifle, but were imbued with the Napoleonic faith in a bold attack. They won. The German infantry had to come out into the open, and had to go in to very close range to redress the balance of their inferior rifle. They were well supported by their artillery, and succeeded.

Now, if our artillery cannot follow our infantry with their eyes and support them with their fire whenever wanted without asking, I fail to see how we can work together. And unless we work together, I fail to see how we can succeed when opposed to a well-trained foe.

The truth is that it is neither the gun nor the rifle nor the sword that win battles, but the man behind the gun, the man who holds the rifle, the man who wields the sword; it is always the man who wins the battle.

Nor is it the position defended by even a very superior weapon that has any particular virtue, but rather the men in that position.

The doctrine held by any Army of avoiding losses, when carried too far, has invariably ended in defeat, and it seems to me that the use of indirect fire, carried too far, can only lead to the same result.

I am, Sir,

Your obedient servant,

P. A. Charrier, Captain,
Royal Munster Fusiliers.

NAVAL AND MILITARY CALENDAR.

DECEMBER, 1906.

1st (Sat.) 1st Bn. King's Own Scottish Borderers arrived in Egypt from England in the "Dongola."

" " 2nd Bn. Royal Berkshire Regiment left Egypt for India in the "Dongola."

4th (T.) 2nd Bn. Royal West Kent Regiment arrived at Singapore from Hong Kong in the "Soudan."

5th (W.) 1st Bn. The Sherwood Foresters (Nottinghamshire and Derbyshire Regiment) left Singapore for Madras in the "Soudan."

7th (F.) 1st Bn. Dorsetshire Regiment arrived in England from India in the "Rewa."

" " XLI. Brigade R.F.A. } left India for England and Aden in the "Assaye."
" " 1st Bn. Suffolk Regiment }

12th (W.) 2nd Bn. King's Own Scottish Borderers left Aden for England in the "Assaye."

" " 1st Bn. Sherwood Foresters (Nottinghamshire and Derbyshire Regiment) arrived in Madras from Singapore in the "Soudan."

" " 1st Bn. Suffolk Regiment arrived in Aden from India in the "Assaye."

" " 2nd Bn. Royal Berkshire Regiment arrived in India from Egypt in the "Dongola."

14th (F.) 1st Bn. Lancashire Fusiliers left Egypt for Malta in the "Braemar Castle."

15th (Sat.) Launch of first-class armoured cruiser "Montana" from the yards of the Newport News Shipbuilding and Drydock Company, at Newport News, for United States Navy.

16th (S.) 2nd Bn. Worcestershire Regiment left Ceylon for Bombay in the "Soudan."

17th (M.) Launch of first-class battle-ship "Schleswig-Holstein" from the Germania Yard, Kiel, for German Navy.

18th (T.) 1st Bn. Lancashire Fusiliers arrived in Malta from Egypt in the "Braemar Castle."

" " 1st Bn. Royal West Kent Regiment left Malta for England in the "Braemar Castle."

20th (Th.) 2nd Bn. Worcestershire Regiment arrived in Bombay from Ceylon in the "Soudan."

27th (F.) 1st Bn. Royal West Kent Regiment arrived in England from Malta in the "Braemar Castle."

29th (Sat.) 1st Bn. Argyll and Sutherland Highlanders left India for South Africa in the "Soudan."

FOREIGN PERIODICALS.

NAVAL.

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Le Moniteur de la Flotte. Paris: 1st December, 1906.—"The Promotion of Officers." "The Navy in Parliament." "Morocco." 8th December.—"Comments on the Loss of the "Lutin."" "The Naval Manœuvres: Admiral Fournier's Report." "The Navy in Parliament." "Morocco." 15th December.—"The Promotion of Officers." "The Entry and Reorganisation of the Corps of Mechanics." "The Navy in Parliament." "The Naval Manœuvres: Admiral Fournier's Report" (*continued*). 22nd December.—"The Promotion of Officers" (*continued*). "The Navy in Parliament." "The Bordeaux Naval Exhibition." "The Naval Manœuvres: Admiral Fournier's Report" (*continued*). 29th December.—"The Reflex Action of the Bottom on the Speed of Ships." "The New Destroyers." "The Naval Manœuvres: Admiral Fournier's Report" (*concluded*). "The Navy in Parliament."

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GERMANY.—*Marine Rundschau.* Berlin: December, 1906. — "An Appeal for Erecting at Windhoek a Monument to the Naval Expeditionary Corps and the Crew of the "Habicht."" "The Disturbance of Neutral Trade during the Russo-Japanese War." "The Tactical Value of Speed in Battle-ships." "The International Regulation of Wireless Telegraphy." "The Results of the Trials of the "Lübeck."" "The Historical Development of the Japanese Navy" (*concluded*). "Mishaps to Submarines." "Admiral Fournier's Report on the French Naval Manœuvres, 1906."

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Kavalleristische Monatshefte. Vienna: December, 1906.—"Battle Training of Cavalry" (*continued*). "Clothing, Equipment, and Armament of Cavalry" (*continued*). "The Swedish Cavalry." "Mounted Infantry." "Schweinschädel and Koniggrätz" (*continued*). "Our Charger." "Scouting of the Honvéd Cavalry." "A Famous American Cavalry Raid." "Foreign Cavalry."

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International Administration of Radiotelegraphy." "Conduct of War in the Karst Districts." "The Clothing of Officers in the Field." "New Regulation on Interior Economy in the Russian Army."

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Neue Militärische Blätter. Berlin: November, 1906. No. 21.—"Napoleon at the Height of his Power and his Downfall." "The Mutual Support of Subordinate Commanders at Mukden." "The Raising of the "Novik" and the "Mikasa"" (*concluded*). "The Pioneers in the War in the Far East." "The Number of Field Guns in France." "Mobile Field Kitchens." "Winter Work." "Military Intelligence." No. 22—"Napoleon's Downfall, 1815." "The Development of the Employment of Massed Field Artillery from the Time of Frederick the Great up to the Present Day." "The Mutual Support of Subordinate Commanders at Mukden" (*concluded*). "India and Afghanistan." "The French Heavy Artillery of the Field Army." "A few Remarks about Submarines." "Military Intelligence."

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PORTUGAL.—*Revista de Engenheria Militar.* Lisbon: October, 1906.—"On the Necessity of a Course at the Artillery School for Officers of the Engineers." "The Projected Railway from Quilimane" (*continued*). "An Historical Document: The Cost of a Masonry Wall in the 15th Century."

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RUSSIA.—*Voïennyï Sbórnik.* St. Petersburg: December, 1906.—Has not been received.

SPAIN.—*Memorial de Ingenieros del Ejército.* Madrid: November, 1906.—"An Account of the Results obtained by the Observations of the Total Eclipse of the Sun, 30th August, 1905" (*concluded*). "Field Tent for Surgical Operations in the Military Hospital at Legnono" (*continued*).

Revista Técnica de Infantería y Caballería. Madrid: December, 1906.—"Capitulation of Fortified Towns." "On Military Instruction" (*continued*). "Usefulness of Cavalry in Modern Armies" (*continued*). "The Island of Teneriffe" (*concluded*). 15th December.—"Harassing." "The Policy of the *Statu Quo.*" "On Military Instruction" (*concluded*). "Usefulness of Cavalry in Modern Wars" (*concluded*). "A Hundred Years after Disaster." "The Regimental Schools in Portugal."

Revista Cientifico-Militar y Biblioteca Militar. Barcelona: December, 1906.—"The Spirit of Napoleon's Cavalry" (*concluded*).

SWITZERLAND.—*Revue Militaire Suisse.* Lausanne: December, 1906.—"The IVth Army Corps Manœuvres." "Reform in the Duties of Umpires." "The Attack at Langres" (*concluded*).

UNITED STATES.—*Army and Navy Life.* New York: December, 1906.—"Improvements in Submarine Navigation." "Athletic Sports in the Army." "A Trip to St. Thomas Island, Danish West Indies." "The Age of our Senior Naval Officers." "Army and Navy Homes in California." "My First Buffalo." "The Mistake of Lieutenant Grayson." "The Army Recruiting Service." "A Suggestion for the Arrangement of Stars on the Flag." "First Monuments to Commemorate the Gallant Action of Yale College Boys in Revolutionary Days." "Private Mayher's Christmas." "The Beginning of the U.S. Navy." "Army and Navy Sports." "Found in the Haversack."

NOTICES OF BOOKS.

With Mounted Infantry in Tibet. By Brevet Major W. J. OTTLEY, 34th Sikh Pioneers. London: Smith, Elder & Co., 1906.

With the close of the Tibet Expedition, a large number of books at once appeared, written for the most part by the special correspondents who were permitted to accompany the Mission; but, with the one exception of Colonel Waddell's work, this would seem to be the only one written by an officer of the Expeditionary Force. It is curious to note that while the military authorities in India appear for some reason to have excluded officers and men of Pioneer regiments from participating in training as mounted infantry—a staff officer on application for permission having on one occasion humorously replied that "every opportunity should be taken to train men of Pioneer regiments *to ride in carts*"—at least two-thirds of the mounted infantrymen who served under Major Ottley with such conspicuous success, were not only drawn entirely from those fine regiments, the 23rd and 32nd Pioneers, but had received no previous mounted infantry training whatever—even of the nature indicated by the authority above quoted. In this connection it is perhaps to be regretted, considering the few opportunities which the Indian cavalry have of seeing active service, compared with the other two arms, (in the Tirah Campaign only four regiments of native cavalry were represented out of nearly 35,000 men employed), that it was not found convenient to detail a couple of squadrons of a good shooting cavalry corps for the mounted work of the expedition. The initial difficulties of raising the mounted infantry were enormous, but Major Ottley triumphed over them all, and turned out the very serviceable little force whose deeds are unpretentiously chronicled in these pages. With so small a force employed in so extraordinarily difficult a country, the work of safe-guarding convoys, of reconnaissance, and of pursuit could not possibly have been performed by infantry alone, while much of the respect which the Tibetan soldiery—and more particularly their comic opera generals—early acquired for our arms, was in very great measure due to the improvised force which followed so fast and struck so hard.

Major Ottley's book is illustrated by some capital photographs; but the absence of a map is, perhaps, something of a deprivation. His cheery account of the campaign will intensify the regret which all officers must feel at having lost an opportunity of sharing in so unique an expedition, a regret which will not be diminished at learning from these pages what a singularly harmonious little force it was of which Major Ottley's command formed so important a unit.

The Solution of Tactical Problems. By Lieut.-Colonel J. Layland Needham. London : Hugh Rees, Ltd., 1906.

The author has found in a long experience of instructing that the greater number of officers have no special difficulty in solving the tactical problems, now so much given in military examinations, provided they know how to set about the work. The regulation text-books are all full of excellent matter, and contain the principles governing the dispositions in any possible tactical operation, but neither in the various *Training* manuals themselves nor anywhere else is there any sort of explanation how these principles should be applied. Colonel Needham has found that, as a result, many officers do not know how to begin, and involve themselves hopelessly in matters of comparatively unimportant detail. The author shows in regular sequence how and what steps are to be successively followed, while explanatory comments are given in every case, and generally the application of the teaching of *Combined Training* is throughout adhered to.

There is a very useful chapter on the writing of orders—a very frequent stumbling-block—and another on military engineering, while at the end of the book will be found a summary of *Combined Training* taken section by section. Military students will find this a very handy book.

PRINCIPAL ADDITIONS TO LIBRARY, DECEMBER, 1906.

Memoirs of Prince Metternich, 1773-1815. Edited by Prince Richard Metternich, translated by Mrs. Alexander Napier. 5 Vols. 8vo. £3 12s. 6d. (Richard Bentley & Son.) London, 1880-82.

The Army in 1906. By Rt. Hon. H. O. Arnold-Forster. 8vo. (John Murray.) London, 1906.

Britain's Roll of Glory. By H. D. Parry. 8vo. 6s. (Presented.) (Cassell & Co., Ltd.) London, 1906.

Recollections of a Lucknow Veteran, 1845-1876. By Major-General J. Ruggles. 8vo. 5s. (Longmans, Green & Co.) London, 1906.

Personal Adventures and Anecdotes of an Old Officer. By Colonel J. P. Robertson. 8vo. 12s. 6d. (Edward Arnold.) London, 1906.

The Battle of Tsu-shima. By Captain V. Semenoff. Translated by Captain A. B. Lindsay. Crown 8vo. 3s. 6d. (John Murray.) London, 1906.

The Great Revolt of 1381. By C. OMAN. 8vo. 8s. 6d. (Clarendon Press.) Oxford, 1906.

Napoleon, King of Elba. By PAUL GRUYER. 8vo. 10s. (William Heinemann.) London, 1906.

Les Progrès de l'Artillerie de Campagne Moderne. By General ROHNE. Translated from the German by Lieut.-Colonel FRIQUE. 8vo. 2s. 3d. (Berger-Levrault et Cie.) Paris, 1905.

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The Russo-Japanese War. Part I., with Maps. Compiled by the General Staff, War Office. 8vo. 1s. 6d. (Harrison & Sons.) London, 1906.

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La Guerre Navale Moderne—De Lissa à Tsoushima. By MICHEL MERYS. Crown 8vo. 2s. 6d. (Augustin Challamel.) Paris, 1906.

La Prochaine Guerre. By Général H. BONNAL. 1er Série. Crown 8vo. 1s. 8d. (R. Chapelot et Cie.) Paris, 1906.

L'Armée Russe après la Campagne de 1904-05. By Capitain P. MAHON. Public sous la direction du 2ime Bureau de l'Etat-Major de l'Armée. 8vo. 4s. (R. Chapelot et Cie.) Paris, 1906.

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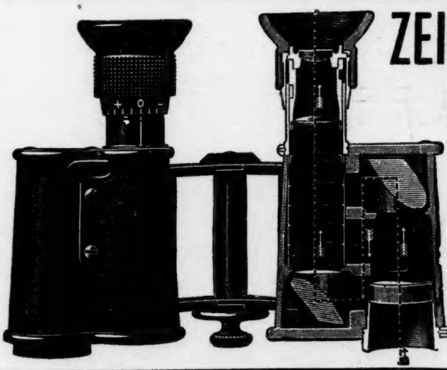
Memoirs of the Royal Artillery Band. By H. G. FARMER. 8vo. 5s. (Boosey & Co.) London, 1904.

The Battle on the Sha-Ho. Translated from the *Militär Wochenblatt* by KARL VON DOUAT. 8vo. (Presented.) (Hugh Rees, Ltd.) London, 1906.

The Nation in Arms. By Baron C. VON DER GOLTZ. Translated by P. A. ASHWORTH. New Edition, revised in accordance with the 5th German Edition. 8vo. (Presented.) (Hugh Rees, Ltd.) London, 1906.



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